Final
Storm Drainage Report

FOR

Towns on 7th

Issaquah, Washington

08/19/2022

Approved By:	Holli H. Heavrin, P.E.
Prepared By:	Katie E. Lane, E.I.T.
Date:	August 19, 2022
Core No:	21416

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1. Project Overview

The Towns on 7th project is comprised of future development of parcels 8844300030, -0031, -0032, -0033, -0027, and -0026 in Issaquah, Washington. The project site borders NW Holly Street to the south, 7th Avenue NW to the east, and Newport Way NW to the west. See vicinity map below for reference. Condominiums, a single-family home and a business border the north to northwest portions of the site. The six existing parcels are located within the valley floor area of downtown Issaquah. Parcels -0033 and -0032 are fully lawn area while the remaining four parcels each have a single home and associated driveway.

The project proposes the construction of six buildings with 29 units as well as associated community space, roads, and sidewalks. In addition to the onsite improvements, the project will also provide frontage improvements along 7th Avenue NW. This project proposes 42,959 square feet of impervious so it will trigger the flow control minimum requirement. The City of Issaquah requires that public and private runoff be separated. Two vaults were sized for this project – one to serve the public ROW and one to serve the remaining private areas. These drainage facilities were designed using the guidelines and requirements established by the Department of Ecology 2014 Stormwater Management Manual for Western Washington (2014 SWMMWW) and the 2017 City of Issaquah Stormwater Design Manual Addendum.

This project proposes 11,971 square feet of pollution generating hard surface. As such, basic water quality treatment will be required for the onsite portion of this site.

Figure 1.1 Vicinity Map

2. Conditions and Requirement Summary

Development of the subject property will be required to comply with the most current version of the City of Issaquah Addendum, which, at this time is the 2017 Stormwater Design Manual Addendum. This publication locally modifies the Washington State Department of Ecology's 2012 Stormwater Management Manual for Western Washington as amended in 2014 (2014 SWMMWW). For any new development project resulting in 5,000 square feet or more of new plus replaced hard surface, all nine Minimum Requirements will apply to the project. This project proposes 42,163 square feet of new plus replaced hard surface, so all nine Minimum Requirements apply and will be addressed

2.1 Minimum Requirements

2.1.1 Minimum Requirement #1 Preparation of Stormwater Site Plans

This report along with the civil plans will satisfy the requirements of this minimum requirement.

2.1.2 Minimum Requirement #2 Construction Stormwater Pollution Prevention (SWPP)

All new development and redevelopment projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters. The project will result in greater than 2,000 square feet of new plus replaced hard surface area and will disturb more than 7,000 square feet of land. Therefore, this project is required to prepare a Construction SWPP Plan (SWPPP) as part of the Stormwater Site Plan. The Construction SWPPP will include a narrative and plan that will show compliance with the 13 Construction SWPPP Elements. Additionally, the project will comply with the City TESC Program. See Section 8 of this Report for additional information.

2.1.3 Minimum Requirement #3 Source Control of Pollution

The proposed project will consist of only residential development which typically does not present a need for source control of pollutants.

2.1.4 Minimum Requirement #4 Preservation of Natural Drainage Systems and Outfalls

The project will maintain the natural drainage outfall to the maximum extent feasible. See Section 3 of this report for a discussion of the existing outfall.

2.1.5 Minimum Requirement #5 On-Site Stormwater Management

List #2 has been chosen for project evaluation of BMPs per the LID flowchart from the 2014 SWMMWW. See Section 4 for a more detailed discussion of stormwater BMPs as they relate to this project.

2.1.6 Minimum Requirement #6 Runoff Treatment

Runoff treatment has been evaluated for the project per Chapter V-2 of the 2014 SWMMWW. The project is required to provide basic runoff treatment and has chosen to provide a biopod downstream of the onsite detention vault to meet this requirement. See Section 4 for more information on runoff treatment design and the runoff treatment flow chart included at the end of this section.

2.1.7 Minimum Requirement #7 Flow Control

This project proposes the use of two vaults to meet this minimum requirement – one to serve the onsite runoff and the other to serve the runoff from the frontage improvements. The project site is located in the valley floor area of downtown Issaquah and, as such, the project is subject to the Central Issaquah Area Alternative Flow Control Standard. See Section 4 of this report for additional information regarding how this project will meet the Central Issaquah Area Alternative Flow Control Standard using the two proposed vaults. WWHM has been used to size the stormwater vaults and WWHM reports are provided in Appendix A for reference.

2.1.8 Minimum Requirement #8 Wetlands Protection

There are no known wetlands along the downstream path for the site so this minimum requirement does not apply.

2.1.9 Minimum Requirement #9 Operations and Maintenance

See Section 10 for further information regarding the Operations and Maintenance Manual for the project.

3. Off-Site Analysis

3.1.1 Task 1: Study Area Definition

The site is located at 765 7TH Avenue NW Issaquah. The parcel is bounded by 7th Avenue NW on the eastern side of the property, NW Holly Street to the south and Newport Way on the west. The north and northwest sections are bordered by condominiums, a single-family home, and a business.

Table 3.1 Site Parcels
884430-0026
884430-0027
884430-0030
884430-0031
884430-0032
834430-0033

Project design will follow standards and requirements established in the following references: Department of Ecology 2014 Stormwater Management Manual for Western Washington (2014 SWMMWW) and the 2017 City of Issaquah Design Manual Addendum.

Figure 3.1 Vicinity Map

3.1.2 Task 2: Resource Review

The site is in the Sammamish River watershed. The surrounding areas to the site were reviewed for potential problems as specified in the 2014 SWMMWW and the 2017 City of Issaquah Stormwater Design Manual Addendum.

Basin Plan
The site is in the Issaquah Creek drainage basin.

Federal Emergency Management Agency Maps
The site is outside of Special Flood Hazard Areas but the northeast corner of the site does cross into a .2% Annual Chance Flood Hazard area (Zone x). The site is in FEMA map 53033C0691J, Eff.8/19/2020.

Critical Aquifer Recharge Area Maps
The site is located outside the local CARA wellhead zones

Sensitive Areas
The site does not overlap any sensitive areas based on based on surveyed sources.

Geotechnical Report

Dated:	August 1, 2022
Prepared by:	Terra Associates, Inc
	12220 113th Avenue NE
	Kirkland, Washington 98034

Onsite native soils were found to be alluvial deposits with scattered layers of sand and gravel with silty clay to clayey silt extending to 21.8 feet below ground surface. Light groundwater seepage was observed in four test pits from 3.5 to 7 feet below ground surface.

King County Soils Survey
The site's soil is made up of Briscot Silt loam (Br). That soil is designated Nation Resource Conservation Service class B/D and classified as poorly drained.

Downstream Drainage Complaints/Response
There were no drainage complaints observed in the downstream path of this site.

3.1.3 Task 3: Field Investigation

The site visit was conducted August 16, 2022. Weather was low 80s with minimal precipitation preceding the visit.

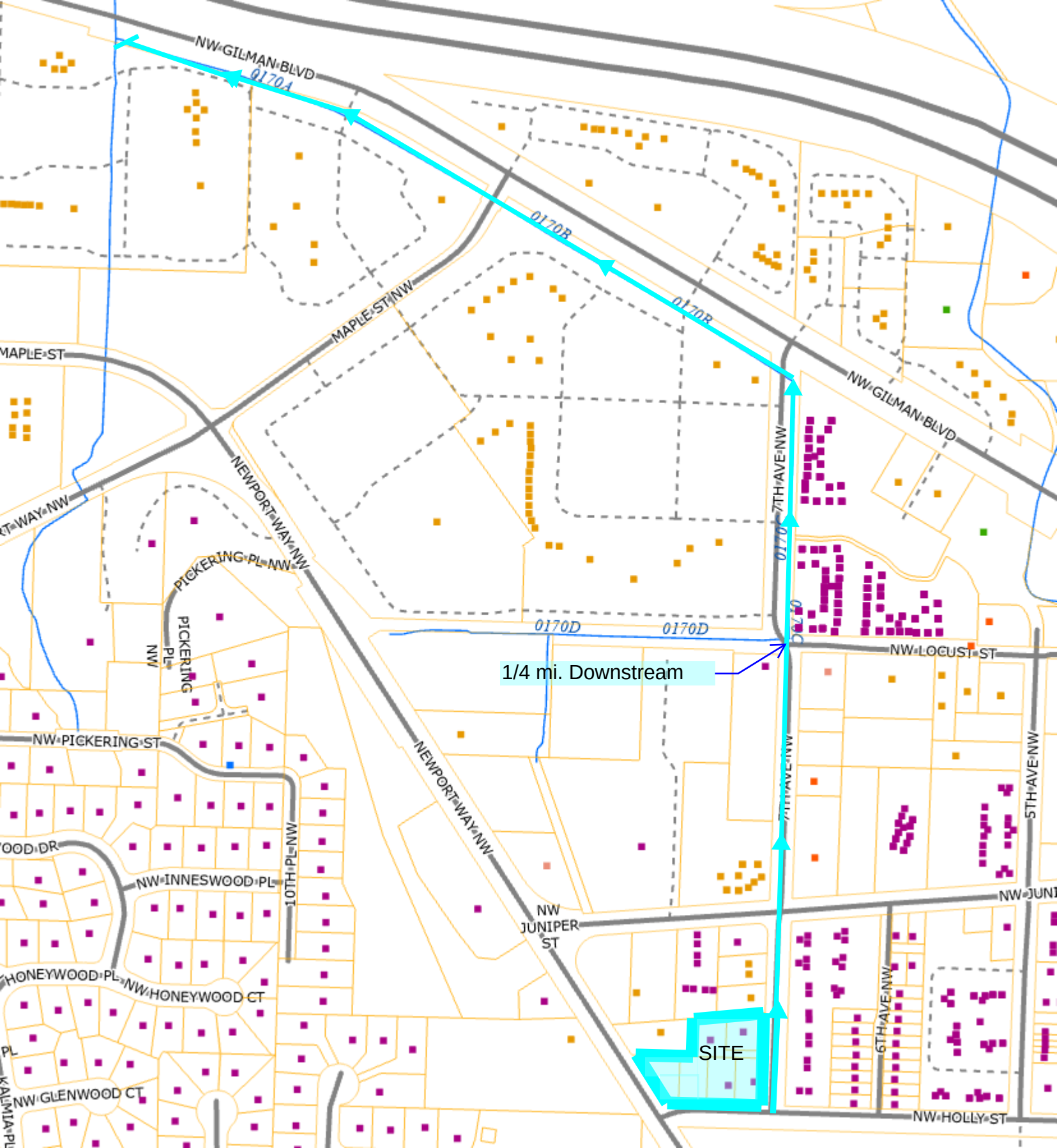
Upstream Tributary Area

This site has no significant tributary area, any runoff from the hills on the west is conveyed away by the roadside ditch. road slopes on Holly Street NW and 7th Avenue NW run away from the site to the east and north respectively.

Downstream Flow Path

The far western corner of the site has a low ditch next to Newport Road collecting runoff, until spilling into NW Holly Street on the southern border of the property. There is a type 1 catch basin on the corner of Newport Way NW and NW Holly Street, running east roughly 60 LF to another catch basin on the east side of a gravel driveway. This pipe continues roughly 100 LF to a catch basin on the corner of NW Holly Street and 7th Avenue NW. This line crosses under 7th Avenue NW roughly 30 LF and turns north at a stormdrain manhole. This estimated 2-foot diameter pipe runs north roughly 200 LF until meeting another stormdrain manhole. This is the junction from the storm drain on the far northeast corner of the property that is located to catch runoff from a shallow swale on the east boundary of the property. Most of the property gently slopes to this location, making the gentle swale on the far east border and the stormdrain the main outflow for sheet flow moving east. This stormdrain crosses under 7th Avenue SW and meets the line flowing up from the south. All drains were observed to be clear and flowing. The pipe on the east side of 7th Avenue NW continues roughly 300 LF to the intersection of NW Jumper Street and 7th Avenue NW. There are three stormdrain manholes spaced roughly 20 LF apart to connect drains on the corners. The main line continues north on 7th Avenue NW roughly 700 LF up to the intersection of NW Locust Street and 7th Avenue NW. There are three stormdrain manholes near the midpoint of the block, spaced 10 LF and 20 LF apart. NW Locust Street marks 1/4 mile from the site, although the investigation continued roughly a half mile up 7th Avenue NW, through a series of storm drain manholes and catch basins, followed by large bioswales roughly .7 mile downstream on NW Gilman Blvd. These were well maintained, but had some standing water.

End of analysis. See Downstream Map in the following pages for reference.


NW GILMAN BLVD
0170A
0170B
0170B
MAPLE ST NW
MAPLE ST
NEWPORT WAY NW
PICKERING PL NW
PICKERING PL NW
NW PICKERING ST
0170D
0170D
0170
7TH AVE NW
NW GILMAN BLVD
NW LOCUST ST
1/4 mi. Downstream
NEWPORT WAY NW
NW JUNIPER ST
10TH PL NW
NW INNESWOOD PL
HONEYWOOD PL NW
NW HONEYWOOD CT
NW GLENWOOD CT
SITE
6TH AVE NW
5TH AVE NW
NW HOLLY ST

4. Flow Control and Water Quality Facility Analysis and Design

4.1 Flow Control Facility Analysis and Design

Per the City of Issaquah Addendum and Figure 7 therein, the site is located within the valley floor area of downtown Issaquah. As such, the pre-development condition can be assumed to be existing conditions rather than forested conditions. Table 4.1 below summarizes the existing conditions for the disturbed areas.

Table 4.1 Predeveloped Areas		
	(sf)	(ac)
Driveways, flat	9535	0.219
Sidewalks, flat	529	0.012
Rooftops, flat	7618	0.175
C, Lawn, flat	39907	0.916
Total Onsite Area	*57589*	*1.322*
Impervious	1474	0.034
C, Lawn, flat	2102	0.048
Total Offsite Area	*3576*	*0.082*

The project proposes the construction of six buildings with 29 units as well as associated community space, roads, and sidewalks. In addition to the onsite improvements, the project will also provide frontage improvements along 7th Avenue NW. A summary of the proposed developed areas is included in Table 4.2 below.

Table 4.2 Developed Areas		
	(sf)	(ac)
Driveways, flat	12769	0.264
Sidewalks, flat	4813	0.104
Rooftops, flat	21866	0.517
C, Lawn, flat	18142	0.437
Total Onsite Area	*57589*	*1.322*
Impervious	2075	0.048
C, Lawn, flat	1502	0.034
Total Offsite Area	*3576*	*0.082*

Tables 4.1 and 4.2 above summarize the areas used for modeling the two vaults. All runoff from improved frontage areas will be treated by the public vault while onsite developed areas will be treated by the private vault. The proposed vault within the ROW has been designed to serve an area equal to that proposed to be added by development of the project site. The 2012 Western Washington Hydrologic Model (WWHM) was used to model the two proposed vaults and the full WWHM Reports are provided in Appendix A.

Public (Offsite) Vault
Required Volume: 144 cubic feet
Proposed Volume: 144 cubic feet

Private (Onsite) Vault
Required Volume: 8,712 cubic feet
Provided Volume: 8,712 cubic feet

4.2 Runoff Treatment Analysis and Design

Per the discussion in Section 2.1.6 of this report, the project site is subject to basic water quality treatment. In order to meet this requirement, an Oldcastle Biopod, which has DOE GULD approval for enhanced treatment is proposed downstream of the onsite vault. The Biopod was sized based on the 2-year release rate from the vault (0.129 cfs). The selected model, BPU 412, has a maximum treatment flowrate of 0.142 cfs which is greater than the 2-year release rate. As such, the treatment facility is considered to be adequately sized.

For the proposed frontage improvements, basic water quality treatment is also required and will be provided upstream of the proposed vault. The Biopod was sized based on the water quality flow rate for the undetained runoff (0.0103 cfs). The selected model, BPU 44EB, has a maximum treatment flowrate of 0.029 cfs which is greater than the water quality flow rate so the treatment facility is considered to be adequately sized.

Table 4.1 Predeveloped Areas		
	(sf)	(ac)
Driveways, flat	9535	0.219
Sidewalks, flat	529	0.012
Rooftops, flat	7618	0.175
C, Lawn, flat	39907	0.916
Total Onsite Area	*57589*	*1.322*
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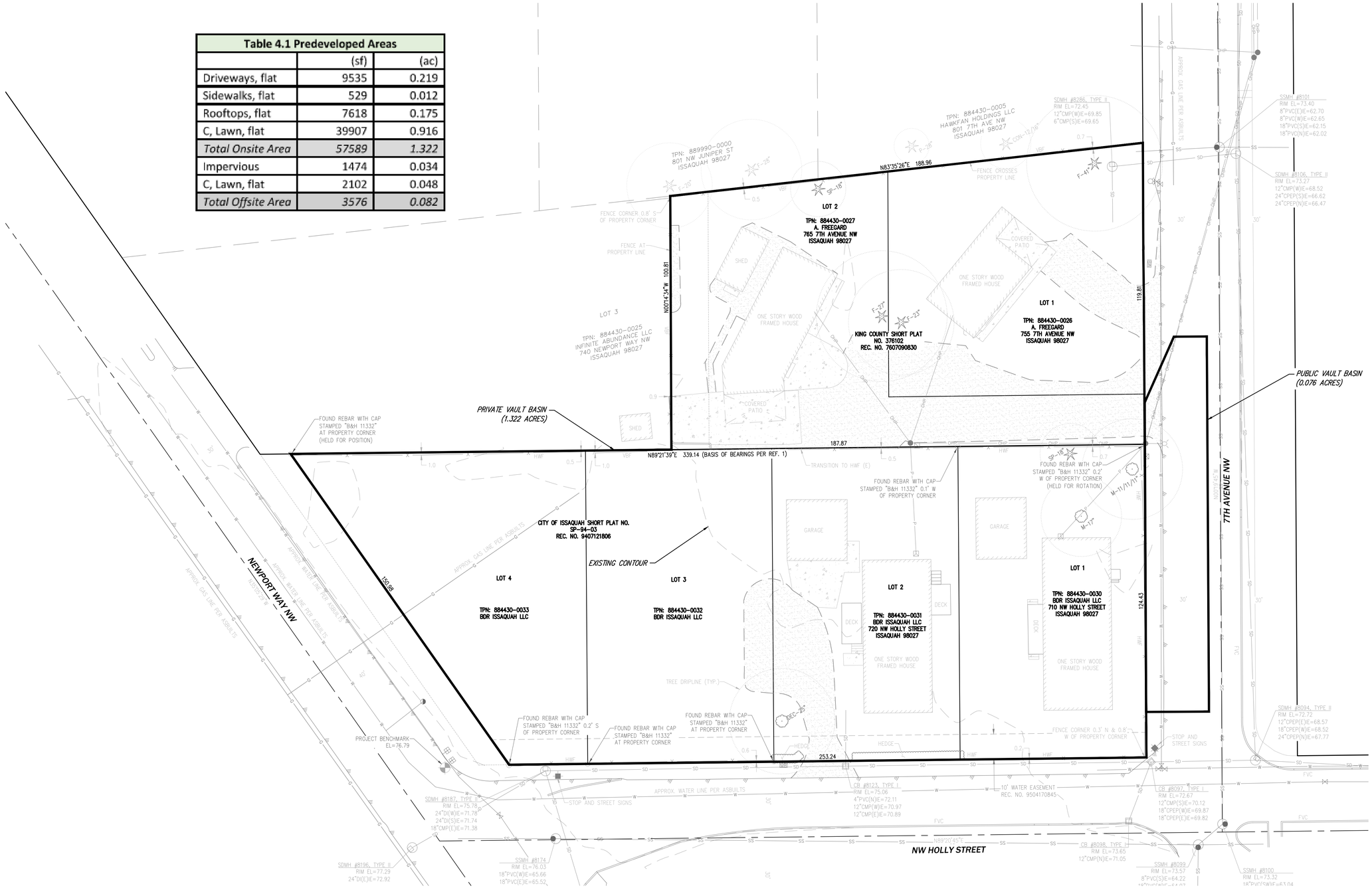

NO.	REVISIONS

CIVIL ENGINEERING
LANDSCAPE ARCHITECTURE
PLANNING
SURVEYING

CORE DESIGN

12100 NE 195th St, Suite 300 Bothell, Washington 98011 425.885.7877

PREDEVELOPED CONDITIONS EXHIBIT
HOLLY STREET TOWNHOMES

DATE 8/18/2022
DESIGNED KEL
DRAWN KEL
APPROVED HHH

HOLLI H. HEAVRIN, P.E.
PROJECT MANAGER

SHEET | OF

PROJECT NUMBER
21416

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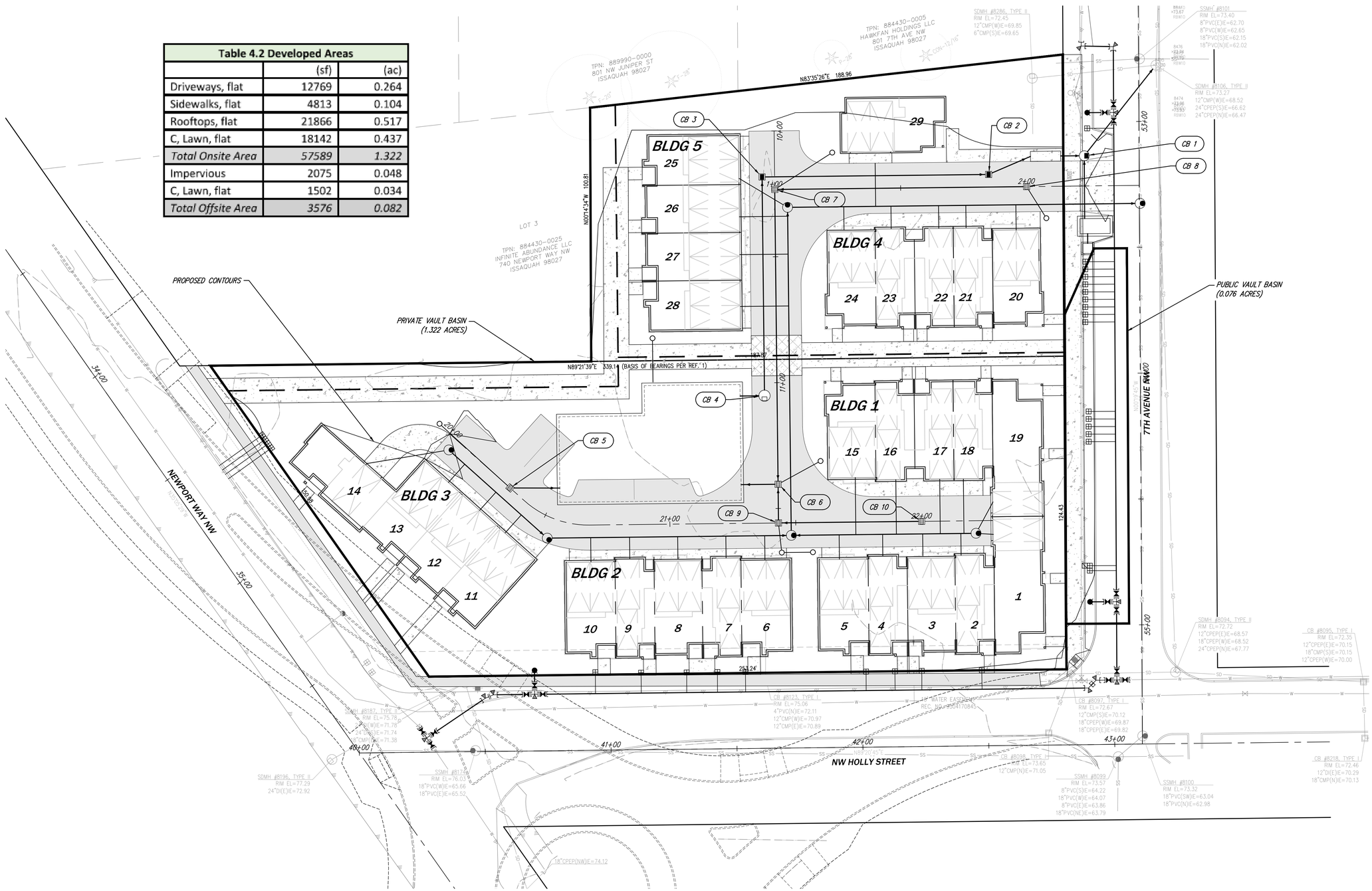
Table 4.2 Developed Areas		
	(sf)	(ac)
Driveways, flat	12769	0.264
Sidewalks, flat	4813	0.104
Rooftops, flat	21866	0.517
C, Lawn, flat	18142	0.437
Total Onsite Area	*57589*	*1.322*
Impervious	2075	0.048
C, Lawn, flat	1502	0.034
Total Offsite Area	*3576*	*0.082*



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APPROVED HHH

HOLLI H. HEAVRIN, P.E.
PROJECT MANAGER

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PROJECT NUMBER
21416

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5. Conveyance System and Analysis and Design

The conveyance systems for each vault were designed for the 200-year, 24-hour storm event. Conveyance spreadsheets were generated for these systems using the rational method to calculate flows for each area collected by each catch basin. The precipitation rate for the 100-year, 24-hour storm event is 5.15 inches as indicated on the isopluvial map provided in the following pages. The flows generated from the conveyance system spreadsheets for the storm event were input into backwater analysis spreadsheets to confirm adequate sizing.

The backwater analysis was performed to ensure that the headwater elevation in each structure did not overtop any of the rims during the 100-year, 24-hour storm. In analyzing the system for the 100-year, 24-hour storm event, capacity is confirmed for all smaller events, including the 25-year, 24-hour storm event, as required by the 2014 SWMMWW.

A weighted C-value for each of the vault basin areas was used in the rational method spreadsheets. Impervious area has a C value of 0.9 and grass area has a C value of 0.25. These values, along with the impervious area and grass area of each respective basin, as used in the WWHM analysis and repeated in Table 5-1 for clarity, were used to calculate the weighted C value. See sample calculation below and the calculated C values in Table 5-5.

$$C_{Private\ Vault} = \frac{(0.048 * 0.9) + (0.034 * 0.25)}{0.082} = 0.80$$

Table 5.1 Curve Numbers	
Off-site areas	0.80
On-site areas	0.70

The tailwater elevation for each vault during the 100-year storm were determined as the maximum water surface elevation within the vault. These elevations for the private and public vaults were 74.0 and 69.81 respectively.

During the 100-year storm, all but one headwater elevations remained at or below the rim elevations of all catch basins. The one catch basin where the headwater exceeds the rim elevation is CB 9 at the low point in Road C. However, the headwater elevation will remain lower than the edge of pavement so this poses no flooding risk to nearby houses. The conveyance systems, therefore, meet the requirements of the 2014 SWMMWW and 2017 Issaquah Addendum.

See the conveyance and backwater spreadsheets for the 100-year storm for the two vaults in the following pages. A Conveyance Exhibit is also provided showing the area assumed to drain to each catch basin.

BACKWATER CALCULATIONS

PROJECT NAME: Towns on 7th **PREPARED BY:** KEL

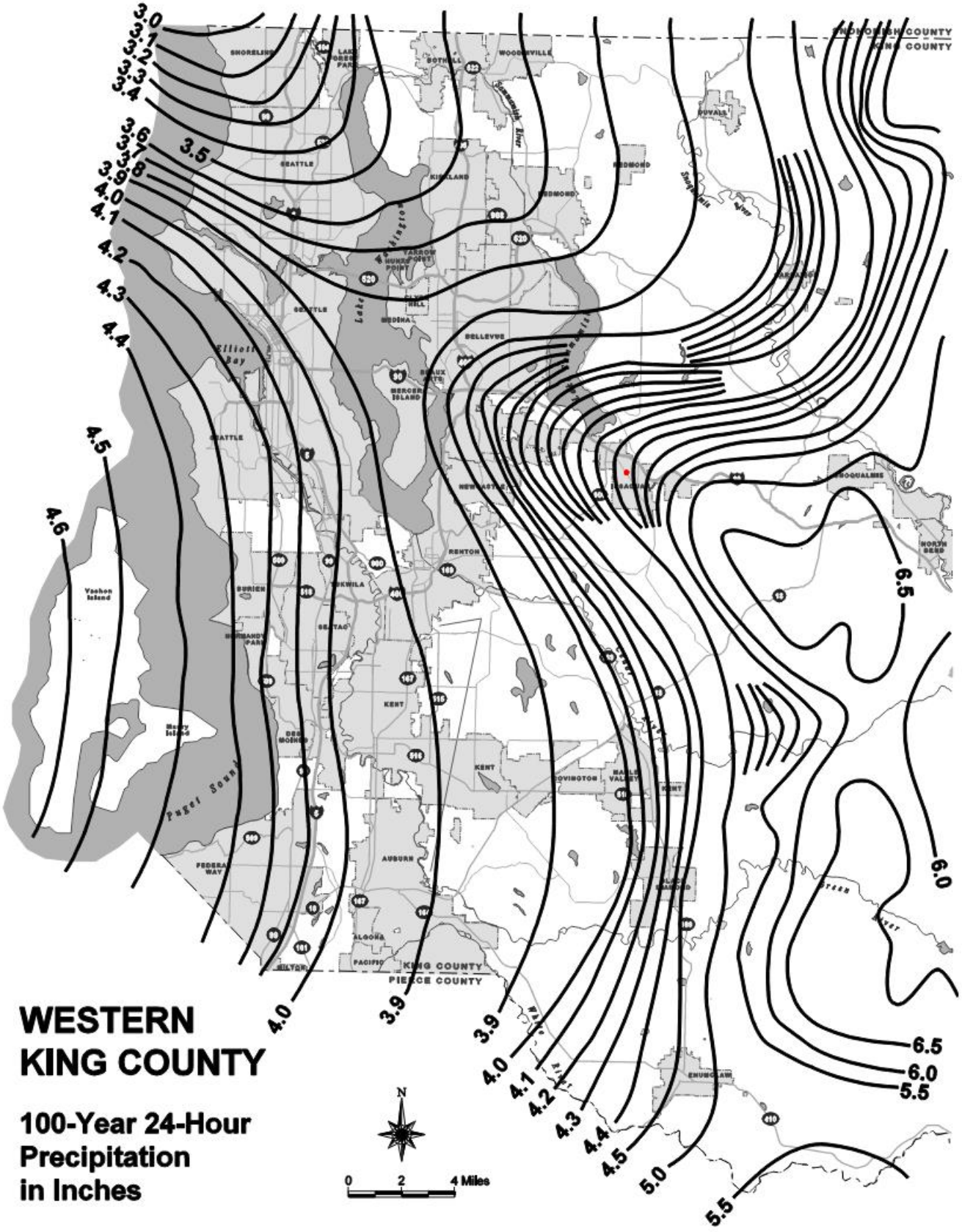
PROJECT NUMBER: 21416 **DESIGN STORM:** 100 YEAR

PIPE SEGMENT FROM CB	PIPE SEGMENT TO CB	Q (CFS)	PIPE LENGTH (FT)	PIPE SIZE (IN)	MANNING'S "n" VALUE	OUTLET ELEVATION (FT)	INLET ELEVATION (FT)	PIPE AREA (SQ FT)	FULL VELOCITY (FT/SEC)	VELOCITY HEAD (FT)	TAILWATER ELEVATION (FT)	FRICTION LOSS (FT)	ENTRANCE HGL ELEVATION (FT)	ENTRANCE HEAD LOSS (FT)	EXIT HEAD LOSS (FT)	OUTLET CONTROL ELEVATION (FT)	INLET CONTROL ELEVATION (FT)	APPROACH VELOCITY HEAD (FT)	BEND HEAD LOSS (FT)	JUNCTION HEAD LOSS (FT)	HEADWATER ELEVATION (FT)	RIM ELEVATION (FT)	FREEBOARD (FT)
OW Vau	Biopod	0.22	4	12	0.012	70.01	70.03	0.79	0.28	0.00	69.81	0.00	71.03	0.00	0.00	71.03	71.03	0.00	0.00	0.00	71.03	73.50	2.47
nsite Vau	5	0.56	20	12	0.012	71.02	71.25	0.79	0.71	0.01	74.00	0.00	74.00	0.00	0.01	74.02	72.25	0.00	0.00	0.00	74.02	75.66	1.64
nsite Vau	6	2.10	15	12	0.012	71.00	71.09	0.79	2.67	0.11	74.00	0.04	74.04	0.06	0.11	74.21	72.09	0.01	0.00	0.08	74.29	74.52	0.23
6	7	0.57	117	12	0.012	71.09	71.68	0.79	0.73	0.01	74.29	0.03	74.31	0.00	0.01	74.32	72.68	0.00	0.01	0.00	74.33	74.99	0.66
7	8	0.39	100	12	0.012	71.68	72.18	0.79	0.49	0.00	74.33	0.01	74.34	0.00	0.00	74.35	73.18	0.02	0.00	0.00	74.32	74.76	0.44
6	9	0.97	15	12	0.012	71.06	71.17	0.79	1.23	0.02	74.29	0.01	74.30	0.01	0.02	74.33	72.17	0.00	0.03	0.00	74.36	74.21	-0.15
9	10	0.05	57	12	0.012	71.17	71.45	0.79	0.07	0.00	74.36	0.00	74.36	0.00	0.00	74.36	72.45	0.00	0.00	0.00	74.36	74.78	0.42

RATIONAL METHOD CONVEYANCE SYSTEM DESIGN

LOCATION:		**KING COUNTY**												**P_R (24-HR RAINFALL):**		**5.15**	**INCHES**	
PROJECT NAME:		**Towns on 7th**			**PROJECT NUMBER:**		**21416**		**PREPARED BY:**		**KEL**			**DESIGN STORM:**		**100**	**YEAR**	
LOCATION		**SUBBASIN AREA**			**SUM OF**	**Tc**	**I_R**	**Q_R**	**MANNING'S**	**PIPE SIZE**	**PIPE SLOPE**	**PIPE LENGTH**	**ACTUAL VELOCITY (V_R)**	**TRAVEL TIME**	**PIPE CAPACITY SUMMARY**		
FROM	**TO**	**(AC)**	**"C"**	**(A * C)**	**(A * C)**	**(MIN)**	**(IN/HR)**	**(CFS)**	**"n"**	**(IN)**	**(%)**	**(FT)**	**(FT/SEC)**	**(MIN)**	**Q(FULL) (CFS)**	**V(FULL) (FT/SEC)**	**Q_R/Q(FULL) (%)**
10	9	0.018	0.70	0.013	0.013	6.30	4.22	0.053	0.012	12	0.500	57	1.06	0.89	2.729	3.47	1.9%
9	6	0.338	0.70	0.237	0.249	7.19	3.88	0.966	0.012	12	0.500	15	3.13	0.08	2.729	3.47	35.4%
8	7	0.144	0.70	0.101	0.101	7.28	3.85	0.388	0.012	12	0.500	100	2.42	0.69	2.729	3.47	14.2%
7	6	0.081	0.70	0.057	0.158	7.97	3.64	0.573	0.012	12	0.500	117	2.69	0.72	2.729	3.47	21.0%
6	Onsite Vault	0.289	0.70	0.202	0.609	8.69	3.44	2.096	0.012	12	0.640	15	4.21	0.06	3.088	3.93	67.9%
5	Onsite Vault	0.234	0.70	0.164	0.164	8.75	3.43	0.561	0.012	12	1.160	20	3.52	0.09	4.157	5.29	13.5%
Biopod	ROW Vault	0.082	0.80	0.066	0.066	8.84	3.41	0.223	0.012	12	0.500	4	2.05	0.03	2.729	3.47	8.2%

FIGURE 3.2.1.D 100-YEAR 24-HOUR ISOPLUVIALS



PROPOSED STORM CONNECTION TO EXISTING

AREA TRIBUTARY TO CB 7 (0.081 AC)

BIOPOD 412IB TO SERVE PRIVATE VAULT BASIN

BYPASS AREA (0.006 AC)

PROPOSED SEWER

PUBLIC VAULT 6' X 12' X 2' LIVE STORAGE

BIOPOD 44EB TO SERVE PUBLIC VAULT BASIN

AREA TRIBUTARY TO CB 8 (0.144 AC)

PUBLIC VAULT BASIN (0.082 ACRES)

AREA TRIBUTARY TO CB 6 (0.289 AC)

AREA TRIBUTARY TO CB 10 (0.018 AC)

AREA TRIBUTARY TO CB 9 (0.338 AC)

AREA TRIBUTARY TO CB 5 (0.234 AC)

PUBLIC VAULT 8,712 CF LIVE STORAGE TO BE CONSTRUCTED OF RTANKS

BLDG 5 DIRECTLY TRIBUTARY TO VAULT

PROPOSED WATER

TPN: 884430-0005
HAWKFAN HOLDINGS LLC
801 7TH AVE NW
ISSAQUAH 98027

801 NW ...
ISSAQUAH 98027

LOT 3

TPN: 884430-0025
INFINITE ABUNDANCE LLC
740 NEWPORT WAY NW
ISSAQUAH 98027

N83°35'26"E 188.96

N00°14'34"W 100.81

N89°21'39"E 339.14 (BASIS OF BEARINGS PER REF. 1)

187.87'

124.43'

262.24'

CB 1
CB 2
CB 3
CB 4
CB 5
CB 6
CB 7
CB 8
CB 9
CB 10

BLDG 1
BLDG 2
BLDG 3
BLDG 4
BLDG 5

7TH AVENUE NW

NEWPORT WAY NW

NW HOLLY STREET

SDMH #8286, TYPE II
RIM EL=72.45
12"CMP(W)E=69.85
6"CMP(S)E=69.65

SSMH #8101
RIM EL=73.40
8"PVC(E)E=62.70
8"PVC(W)E=62.65
18"PVC(S)E=62.15
18"PVC(N)E=62.02

SDMH #8106, TYPE II
RIM EL=73.27
12"CMP(W)E=68.52
24"CPEP(S)E=66.62
24"CPEP(N)E=66.47

SDMH #8094, TYPE II
RIM EL=72.72
12"CPEP(E)E=68.57
18"CPEP(W)E=68.52
24"CPEP(N)E=67.77

CB #8095, TYPE I
RIM EL=72.55
12"CPEP(E)E=70.15
18"CMP(S)E=70.15
12"CPEP(W)E=70.00

CB #8123, TYPE I
RIM EL=75.06
4"PVC(N)E=72.11
12"CMP(W)E=70.97
12"CMP(E)E=70.89

HLD WATER EASEMENT
REC. NO. 9504170845

CB #8097, TYPE I
RIM EL=72.67
12"CMP(S)E=70.12
18"CPEP(W)E=69.87
18"CPEP(E)E=69.82

CB #8098, TYPE I
RIM EL=73.65
12"CMP(N)E=71.05

SSMH #8099
RIM EL=73.57
8"PVC(S)E=64.22
18"PVC(W)E=64.07
8"PVC(E)E=63.86
18"PVC(NE)E=63.79

SSMH #8100
RIM EL=73.32
18"PVC(SW)E=63.04
18"PVC(N)E=62.98

CB #8218, TYPE I
RIM EL=72.46
12"DI(E)E=70.29
18"CMP(N)E=70.13

SDMH #8187, TYPE II
RIM EL=75.78
8"PVC(W)E=71.78
24"DI(E)E=71.74
18"CMP(E)E=71.38

SSMH #8174
RIM EL=76.01
18"PVC(W)E=65.66
18"PVC(E)E=65.52

SDMH #8196, TYPE II
RIM EL=77.29
24"DI(E)E=72.92

18"CPEP(NW)E=74.12

REVISIONS

NO.

CIVIL ENGINEERING
LANDSCAPE ARCHITECTURE
PLANNING
SURVEYING

CORE DESIGN

12100 NE 195th St, Suite 300 Bothell, Washington 98011 425.885.7877

DEVELOPED CONDITIONS EXHIBIT
HOLLY STREET TOWNHOMES

DATE 8/18/2022
DESIGNED KEL
DRAWN KEL
APPROVED HHH

HOLLI H. HEAVRIN, P.E.
PROJECT MANAGER

SHEET | OF

PROJECT NUMBER
21416

8/18/2022 10:16 AM - X:\2021\21416\ENGINEERING\EXHIBITS\TBR\DEV CON.DWG

6. Special Reports and Studies

The following reports have been submitted under separate cover.

The following reports and assessments are provided for reference and informational purposes only. Core Design takes no responsibility or liability for these reports, assessments or designs as they were not completed under the direct supervision of Core Design.

- Geotechnical Report
  Dated: August 1, 2022
  Prepared by: Terra Associates, Inc.
  12220 113th Avenue NE, Ste. 130
  Kirkland, WA 98034

7. Other Permits

There are no other applicable permits at this time.

8. Erosion and Sedimentation Control Analysis and Design

The site will utilize Volume II of the 2014 SWMMWW for the erosion and sedimentation control design to reduce the discharge of sediment -laden runoff from the site. A perimeter protection will be provided by silt fencing along the site perimeter and a stabilized construction entrance will limit the downstream transport of sediment.

Dust control, if required, will be provided by a water truck. A Certified Erosion and Sediment Control lead inspector will be present onsite during earthwork activities. The inspector shall determine the frequency of watering of the project site and will authorize and direct any additional erosion and sediment control measures as needed during all construction activities.

Additional information for how the project will comply with the 13 elements will be provided in the SWPPP which has been prepared and submitted under separate cover.

Sediment Trap Sizing:

The 1.323 acre site proposes to use one sediment trap to control the discharge of sediment from the site. Per BMP C240, the surface area of a temporary sediment pond when construction is done during the wet season is calculated using the following equation:

$$SA = 2080 * Q_{10}$$

Where SA is the required surface area of the sediment trap and Q_{10} is the 10-year peak flow of the developed basin. Peak flows for the full project site were modeled using WWHM, the output of which is shown below.

Flow Frequency			
Flow(cfs)		Predeveloped	Mitigated
2 Year	=	0.2653	0.4990
5 Year	=	0.3622	0.6381
10 Year	=	0.4336	0.7355
25 Year	=	0.5324	0.8648
50 Year	=	0.6125	0.9659
100 Year	=	0.6982	1.0711

The required surface area at the top of the riser of the sediment pond, using the 10-year peak flow of 0.7355 cubic feet per second, was found to be:

$$SA = 2080 * Q_{10} = 2080 * 0.7355cfs$$

$$SA = 1{,}530\ sf$$

Thus, the proposed dimensions of the sediment pond at the top of the riser are 23 feet by 69 feet, or a surface area of 1,587 square feet. Per the standards set forth in Volume II of the 2019 SWMMWW, the pond will be a minimum of 3.5 feet deep with 3:1 internal slopes and one foot of freeboard.

9. Bond Quantities, Facility Summaries and Declaration of Covenant

A bon quantity worksheet has been provided in the following pages.

Site Improvement Bond Quantity Worksheet

King County

Department of Permitting & Environmental Review
35030 SE Douglas Street, Suite 210
Snoqualmie, Washington 98065-9266
206-296-6600 TTY Relay 711

For alternate formats, call 206-296-6600.

Project Name: Towns on 7th
Location: Issaquah, WA
Date: 8/18/2022
Project No.:
Activity No.:

Clearing greater than or equal to 5,000 board feet of timber?

yes _____ no

If yes,
Forest Practice Permit Number: _____
(RCW 76.09)

Note: All prices include labor, equipment, materials, overhead and profit. Prices are from RS Means data adjusted for the Seattle area or from local sources if not included in the RS Means database.

Unit prices updated: 3/2/2015
Version: 3/2/2015
Report Date: 8/18/2022

Site Improvement Bond Quantity Worksheet

		Reference #	Unit Price	Unit	Quantity	# of Applications	Cost
EROSION/SEDIMENT CONTROL	**Number**						
Backfill & compaction-embankment	**ESC-1**		$ 6.00	CY			
Check dams, 4" minus rock	**ESC-2**	SWDM 5.4.6.3	$ 80.00	Each	15	1	1200
Crushed surfacing 1 1/4" minus	**ESC-3**	WSDOT 9-03.9(3)	$ 95.00	CY			
Ditching	**ESC-4**		$ 9.00	CY	43	1	387
Excavation-bulk	**ESC-5**		$ 2.00	CY			
Fence, silt	**ESC-6**	SWDM 5.4.3.1	$ 1.50	LF	1144	1	1716
Fence, Temporary (NGPE)	**ESC-7**		$ 1.50	LF			
Hydroseeding	**ESC-8**	SWDM 5.4.2.4	$ 0.80	SY	2281	1	1825
Jute Mesh	**ESC-9**	SWDM 5.4.2.2	$ 3.50	SY			
Mulch, by hand, straw, 3" deep	**ESC-10**	SWDM 5.4.2.1	$ 2.50	SY			
Mulch, by machine, straw, 2" deep	**ESC-11**	SWDM 5.4.2.1	$ 2.00	SY			
Piping, temporary, CPP, 6"	**ESC-12**		$ 12.00	LF			
Piping, temporary, CPP, 8"	**ESC-13**		$ 14.00	LF			
Piping, temporary, CPP, 12"	**ESC-14**		$ 18.00	LF			
Plastic covering, 6mm thick, sandbagged	**ESC-15**	SWDM 5.4.2.3	$ 4.00	SY			
Rip Rap, machine placed; slopes	**ESC-16**	WSDOT 9-13.1(2)	$ 45.00	CY			
Rock Construction Entrance, 50'x15'x1'	**ESC-17**	SWDM 5.4.4.1	$ 1,800.00	Each			
Rock Construction Entrance, 100'x15'x1'	**ESC-18**	SWDM 5.4.4.1	$ 3,200.00	Each	1	1	3200
Sediment pond riser assembly	**ESC-19**	SWDM 5.4.5.2	$ 2,200.00	Each			
Sediment trap, 5' high berm	**ESC-20**	SWDM 5.4.5.1	$ 19.00	LF	184	1	3496
Sed. trap, 5' high, riprapped spillway berm section	**ESC-21**	SWDM 5.4.5.1	$ 70.00	LF			
Seeding, by hand	**ESC-22**	SWDM 5.4.2.4	$ 1.00	SY			
Sodding, 1" deep, level ground	**ESC-23**	SWDM 5.4.2.5	$ 8.00	SY			
Sodding, 1" deep, sloped ground	**ESC-24**	SWDM 5.4.2.5	$ 10.00	SY			
TESC Supervisor	**ESC-25**		$ 110.00	HR	40	1	4400
Water truck, dust control	**ESC-26**	SWDM 5.4.7	$ 140.00	HR	40	1	5600
WRITE-IN-ITEMS ** (see page 9)**							
				Each			

ESC SUBTOTAL:	$ 21,823.80
30% CONTINGENCY & MOBILIZATION:	$ 6,547.14
ESC TOTAL:	$ 28,370.94
COLUMN:	**A**

Unit prices updated: 3/2/2015
Version: 3/2/2015

Report Date: 8/18/2022

Site Improvement Bond Quantity Worksheet

Web date: 04/03/2015

				Existing Right-of-Way		Future Public Right of Way & Drainage Facilities		Private Improvements		
		Unit Price	Unit	Quant.	Cost	Quant.	Cost	Quant.	Cost	
GENERAL ITEMS	**No.**									
Backfill & Compaction- embankment	GI - 1	$ 6.00	CY					2240	13,440.00	
Backfill & Compaction- trench	GI - 2	$ 9.00	CY							
Clear/Remove Brush, by hand	GI - 3	$ 1.00	SY							
Clearing/Grubbing/Tree Removal	GI - 4	$ 10,000.00	Acre					1.4	14,000.00	
Excavation - bulk	GI - 5	$ 2.00	CY					565	1,130.00	
Excavation - Trench	GI - 6	$ 5.00	CY							
Fencing, cedar, 6' high	GI - 7	$ 20.00	LF							
Fencing, chain link, vinyl coated, 6' high	GI - 8	$ 20.00	LF							
Fencing, chain link, gate, vinyl coated, 20'	GI - 9	$ 1,400.00	Each							
Fencing, split rail, 3' high	GI - 10	$ 15.00	LF							
Fill & compact - common barrow	GI - 11	$ 25.00	CY							
Fill & compact - gravel base	GI - 12	$ 27.00	CY							
Fill & compact - screened topsoil	GI - 13	$ 39.00	CY							
Gabion, 12" deep, stone filled mesh	GI - 14	$ 65.00	SY							
Gabion, 18" deep, stone filled mesh	GI - 15	$ 90.00	SY							
Gabion, 36" deep, stone filled mesh	GI - 16	$ 150.00	SY							
Grading, fine, by hand	GI - 17	$ 2.50	SY							
Grading, fine, with grader	GI - 18	$ 2.00	SY							
Monuments, 3' long	GI - 19	$ 250.00	Each							
Sensitive Areas Sign	GI - 20	$ 7.00	Each							
Sodding, 1" deep, sloped ground	GI - 21	$ 8.00	SY							
Surveying, line & grade	GI - 22	$ 850.00	Day							
Surveying, lot location/lines	GI - 23	$ 1,800.00	Acre							
Traffic control crew (2 flaggers)	GI - 24	$ 120.00	HR							
Trail, 4" chipped wood	GI - 25	$ 8.00	SY							
Trail, 4" crushed cinder	GI - 26	$ 9.00	SY							
Trail, 4" top course	GI - 27	$ 12.00	SY							
Wall, retaining, concrete	GI - 28	$ 55.00	SF							
Wall, rockery	GI - 29	$ 15.00	SF							
		SUBTOTAL							28,570.00	

*KCC 27A authorizes only one bond reduction.

21416 bqw

Unit prices updated: 03/02/2015
Version: 03/02/2015
Report Date: 8/18/2022

Site Improvement Bond Quantity Worksheet

Web date: 04/03/2015

				Existing Right-of-way		Future Public Right of Way & Drainage Facilities		Private Improvements		
		Unit Price	Unit	Quant.	Cost	Quant.	Cost	Quant.	Cost	
ROAD IMPROVEMENT	**No.**									
AC Grinding, 4' wide machine < 1000sy	RI - 1	$ 30.00	SY							
AC Grinding, 4' wide machine 1000-2000s	RI - 2	$ 16.00	SY							
AC Grinding, 4' wide machine > 2000sy	RI - 3	$ 10.00	SY							
AC Removal/Disposal	RI - 4	$ 35.00	SY							
Barricade, type III (Permanent)	RI - 6	$ 56.00	LF							
Curb & Gutter, rolled	RI - 7	$ 17.00	LF							
Curb & Gutter, vertical	RI - 8	$ 12.50	LF	274	3,425.00					
Curb and Gutter, demolition and disposal	RI - 9	$ 18.00	LF							
Curb, extruded asphalt	RI - 10	$ 5.50	LF							
Curb, extruded concrete	RI - 11	$ 7.00	LF							
Sawcut, asphalt, 3" depth	RI - 12	$ 1.85	LF							
Sawcut, concrete, per 1" depth	RI - 13	$ 3.00	LF							
Sealant, asphalt	RI - 14	$ 2.00	LF							
Shoulder, AC, (see AC road unit price)	RI - 15	$ -	SY							
Shoulder, gravel, 4" thick	RI - 16	$ 15.00	SY							
Sidewalk, 4" thick	RI - 17	$ 38.00	SY	223	8,474.00			609	23,142.00	
Sidewalk, 4" thick, demolition and disposal	RI - 18	$ 32.00	SY							
Sidewalk, 5" thick	RI - 19	$ 41.00	SY							
Sidewalk, 5" thick, demolition and disposal	RI - 20	$ 40.00	SY							
Sign, handicap	RI - 21	$ 85.00	Each							
Striping, per stall	RI - 22	$ 7.00	Each							
Striping, thermoplastic, (for crosswalk)	RI - 23	$ 3.00	SF							
Striping, 4" reflectorized line	RI - 24	$ 0.50	LF							
			SUBTOTAL		11,899.00				23,142.00	

*KCC 27A authorizes only one bond reduction.

21416 bqw

Unit prices updated: 03/02/2015
Version: 03/02/2015
Report Date: 8/18/2022

Site Improvement Bond Quantity Worksheet

Web date: 04/03/2015

				Existing Right-of-way		Future Public Right of Way & Drainage Facilities		Private Improvements		
		Unit Price	Unit	Quant.	Cost	Quant.	Cost	Quant.	Cost	
ROAD SURFACING	**No.**	(4" Rock = 2.5 base & 1.5" top course) 9 1/2" Rock= 8" base & 1.5" top course)								
Additional 2.5" Crushed Surfacing	RS - 1	$ 3.60	SY							
HMA 1/2" Overlay, 1.5"	RS - 2	$ 14.00	SY							
HMA 1/2" Overlay 2"	RS - 3	$ 18.00	SY							
HMA Road, 2", 4" rock, First 2500 SY	RS - 4	$ 28.00	SY					1166	32,648.00	
HMA Road, 2", 4" rock, Qty. over 2500 SY	RS - 5	$ 21.00	SY							
HMA Road, 3", 9 1/2" Rock, First 2500 SY	RS - 6	$ 42.00	SY							
HMA Road, 3", 9 1/2" Rock, Qty Over 250	RS - 7	$ 35.00	SY							
Not Used	RS - 8									
Not Used	RS - 9									
HMA Road, 6" Depth, First 2500 SY	RS - 10	$ 33.10	SY							
HMA Road, 6" Depth, Qty. Over 2500 SY	RS - 11	$ 30.00	SY							
HMA 3/4" or 1", 4" Depth	RS - 12	$ 20.00	SY							
Gravel Road, 4" rock, First 2500 SY	RS - 13	$ 15.00	SY							
Gravel Road, 4" rock, Qty. over 2500 SY	RS - 14	$ 10.00	SY							
PCC Road (Add Under Write-Ins w/Desig	RS - 15									
Thickened Edge	RS - 17	$ 8.60	LF							

SUBTOTAL _____ _____ _____

*KCC 27A authorizes only one bond reduction.

21416 bqw

Unit prices updated: 03/02/2015
Version: 03/02/2015
Report Date: 8/18/2022

Site Improvement Bond Quantity Worksheet

Web date: 04/03/2015

				Existing Right-of-way		Future Public Right of Way & Drainage Facilities		Private Improvements		
		Unit Price	Unit	Quant.	Cost	Quant.	Cost	Quant.	Cost	
DRAINAGE (CPP = Corrugated Plastic Pipe, N12 or Equivalent)				For Culvert prices, Average of 4' cover was assumed. Assume perforated PVC is same price as solid pipe.						
Access Road, R/D	D - 1	$ 21.00	SY							
Bollards - fixed	D - 2	$ 240.74	Each							
Bollards - removable	D - 3	$ 452.34	Each							
* (CBs include frame and lid)										
CB Type I	D - 4	$ 1,500.00	Each			8	12,000.00			
CB Type IL	D - 5	$ 1,750.00	Each							
CB Type II, 48" diameter	D - 6	$ 2,300.00	Each			1	2,300.00			
for additional depth over 4'	D - 7	$ 480.00	FT			3	1,440.00			
CB Type II, 54" diameter	D - 8	$ 2,500.00	Each			1	2,500.00			
for additional depth over 4'	D - 9	$ 495.00	FT							
CB Type II, 60" diameter	D - 10	$ 2,800.00	Each							
for additional depth over 4'	D - 11	$ 600.00	FT							
CB Type II, 72" diameter	D - 12	$ 3,600.00	Each							
for additional depth over 4'	D - 13	$ 850.00	FT							
Through-curb Inlet Framework (Add)	D - 14	$ 400.00	Each							
Cleanout, PVC, 4"	D - 15	$ 150.00	Each							
Cleanout, PVC, 6"	D - 16	$ 170.00	Each			7	1,190.00			
Cleanout, PVC, 8"	D - 17	$ 200.00	Each							
Culvert, PVC, 4"	D - 18	$ 10.00	LF							
Culvert, PVC, 6"	D - 19	$ 13.00	LF			141	1,833.00			
Culvert, PVC, 8"	D - 20	$ 15.00	LF							
Culvert, PVC, 12"	D - 21	$ 23.00	LF			651	14,973.00			
Culvert, CMP, 8"	D - 22	$ 19.00	LF							
Culvert, CMP, 12"	D - 23	$ 29.00	LF							
Culvert, CMP, 15"	D - 24	$ 35.00	LF							
Culvert, CMP, 18"	D - 25	$ 41.00	LF							
Culvert, CMP, 24"	D - 26	$ 56.00	LF							
Culvert, CMP, 30"	D - 27	$ 78.00	LF							
Culvert, CMP, 36"	D - 28	$ 130.00	LF							
Culvert, CMP, 48"	D - 29	$ 190.00	LF							
Culvert, CMP, 60"	D - 30	$ 270.00	LF							
Culvert, CMP, 72"	D - 31	$ 350.00	LF							

SUBTOTAL 36,236.00

*KCC 27A authorizes only one bond reduction.

21416 bqw

Unit prices updated: 03/02/2015
Version: 03/02/2015
Report Date: 8/18/2022

Site Improvement Bond Quantity Worksheet

Web date: 04/03/2015

DRAINAGE CONTINUED				Existing Right-of-way		Future Public Right of Way & Drainage Facilities		Private Improvements		
	No.	Unit Price	Unit	Quant.	Cost	Quant.	Cost	Quant.	Cost	
Culvert, Concrete, 8"	D - 32	$ 25.00	LF							
Culvert, Concrete, 12"	D - 33	$ 36.00	LF							
Culvert, Concrete, 15"	D - 34	$ 42.00	LF							
Culvert, Concrete, 18"	D - 35	$ 48.00	LF							
Culvert, Concrete, 24"	D - 36	$ 78.00	LF							
Culvert, Concrete, 30"	D - 37	$ 125.00	LF							
Culvert, Concrete, 36"	D - 38	$ 150.00	LF							
Culvert, Concrete, 42"	D - 39	$ 175.00	LF							
Culvert, Concrete, 48"	D - 40	$ 205.00	LF							
Culvert, CPP, 6"	D - 41	$ 14.00	LF							
Culvert, CPP, 8"	D - 42	$ 16.00	LF							
Culvert, CPP, 12"	D - 43	$ 24.00	LF							
Culvert, CPP, 15"	D - 44	$ 35.00	LF							
Culvert, CPP, 18"	D - 45	$ 41.00	LF							
Culvert, CPP, 24"	D - 46	$ 56.00	LF							
Culvert, CPP, 30"	D - 47	$ 78.00	LF							
Culvert, CPP, 36"	D - 48	$ 130.00	LF							
Ditching	D - 49	$ 9.50	CY							
Flow Dispersal Trench (1,436 base+)	D - 50	$ 28.00	LF							
French Drain (3' depth)	D - 51	$ 26.00	LF							
Geotextile, laid in trench, polypropylene	D - 52	$ 3.00	SY							
Mid-tank Access Riser, 48" dia, 6' deep	D - 54	$ 2,000.00	Each							
Pond Overflow Spillway	D - 55	$ 16.00	SY							
Restrictor/Oil Separator, 12"	D - 56	$ 1,150.00	Each							
Restrictor/Oil Separator, 15"	D - 57	$ 1,350.00	Each							
Restrictor/Oil Separator, 18"	D - 58	$ 1,700.00	Each							
Riprap, placed	D - 59	$ 42.00	CY							
Tank End Reducer (36" diameter)	D - 60	$ 1,200.00	Each							
Trash Rack, 12"	D - 61	$ 350.00	Each							
Trash Rack, 15"	D - 62	$ 410.00	Each							
Trash Rack, 18"	D - 63	$ 480.00	Each							
Trash Rack, 21"	D - 64	$ 550.00	Each							

SUBTOTAL _____ _____ _____

*KCC 27A authorizes only one bond reduction.

21416 bqw

Unit prices updated: 03/02/2015
Version: 03/02/2015
Report Date: 8/18/2022

Site Improvement Bond Quantity Worksheet

Web date: 04/03/2015

				Existing Right-of-way		Future Public Right of Way & Drainage Facilities		Private Improvements		
		Unit Price	Unit	Quant.	Price	Quant.	Cost	Quant.	Cost	
PARKING LOT SURFACING					Not To Be Used For Roads Or Shoulders					
	No.									
2" AC, 2" top course rock & 4" borrow	PL - 1	$ 21.00	SY	NA		NA				
2" AC, 1.5" top course & 2.5" base cours	PL - 2	$ 28.00	SY	NA		NA				
4" select borrow	PL - 3	$ 5.00	SY	NA		NA				
1.5" top course rock & 2.5" base course	PL - 4	$ 14.00	SY	NA		NA				
UTILITY POLES & STREET LIGHTING					Utility pole relocation costs must be accompanied by **Franchise Utility's Cost Estimate**					
Utility Pole(s) Relocation	UP-1	Lump Sum								
Street Light Poles w/Luminaires	UP-2	$ 7,500.00	Each							
WRITE-IN-ITEMS										
(Such as detention/water quality vaults.)	No.									
Stormwater Vault	WI - 1	$ 380,000.00	Each			2	760,000.00			
Block Wall	WI - 2	$ 16.00	SY							
Yard Drain	WI - 3	$ 225.00	CY							
BioPod	WI - 4	$ 60,000.00	Each			2	120,000.00			
	WI - 5		FT							
	WI - 6									
	WI - 7									
	WI - 8									
	WI - 9									
	WI - 10									

SUBTOTAL		880,000.00	
SUBTOTAL (SUM ALL PAGES):	11,899.00	916,236.00	84,360.00
30% CONTINGENCY & MOBILIZATION:	3,569.70	274,870.80	25,308.00
GRANDTOTAL:	15,468.70	1,191,106.80	109,668.00
COLUMN:	**B**	**C**	**D**

*KCC 27A authorizes only one bond reduction.
21416 bqw

Unit prices updated: 03/02/2015
Version: 03/02/2015
Report Date: 8/18/2022

Site Improvement Bond Quantity Worksheet

Web date: 04/03/2015

Original bond computations prepared by:

Name: Holli H Heavrin, PE **Date:** 8/18/2022

PE Registration Number: **Tel. #:** 425-885-7877

Firm Name: Core Design, Inc

Address: 12100 NE 195th St, Suite 300 **Project No:**

FINANCIAL GUARANTEE REQUIREMENTS

		PERFORMANCE BOND* AMOUNT	MINIMUM BOND* AMOUNT REQUIRED FOR RECORDING OR TEMPORARY OCCUPANCY AT SUBSTANTIAL COMPLETION ***	PUBLIC ROAD & DRAINAGE MAINTENANCE/DEFECT BOND*
Stabilization/Erosion Sediment Control (ESC)	(A)	$ 28,370.9		
Existing Right-of-Way Improvements	(B)	$ 15,468.7		
Future Public Right of Way & Drainage Facilities	(C)	$ 1,191,106.8		
Private Improvements	(D)	$ 109,668.0		
Calculated Quantity Completed				
Total Right-of Way and/or Site Restoration Bond*/** (First $7,500 of bond* shall be cash.)	(A+B)	$ 43,839.6		
Performance Bond* Amount (A+B+C+D) = TOTAL	(T)	$ 1,344,614.4 Minimum is $2000.	T x 0.30 $ 403,384.3 Minimum is $2000.	
Maintenance/Defect Bond* Total				(B+C) x 0.25 = $ 301,643.9 Minimum is $2000.

NAME OF PERSON PREPARING BOND* REDUCTION: Date:

*** NOTE:** The word "bond" as used in this document means a financial guarantee acceptable to King County.

**** NOTE:** KCC 27A authorizes right of way and site restoration bonds to be combined when both are required. The restoration requirement shall include the total cost for all TESC as a minimum, not a maximum. In addition, corrective work, both on- and off-site needs to be included. Quantities shall reflect worse case scenarios not just minimum requirements. For example, if a salmonid stream may be damaged, some estimated costs for restoration needs to be reflected in this amount. The 30% contingency and mobilization costs are computed in this quantity.

***** NOTE:** Per KCC 27A, total bond amounts remaining after reduction shall not be less than 30% of the original amount (T) or as revised by major design changes.

REQUIRED BOND* AMOUNTS ARE SUBJECT TO REVIEW AND MODIFICATION BY KING COUNTY

Check out the DDES Web site at www.kingcounty.gov/permits

Unit prices updated: 03/02/2015
Version: 03/02/2015
Report Date: 8/18/2022

21416 bqw

10. Operations and Maintenance Manual

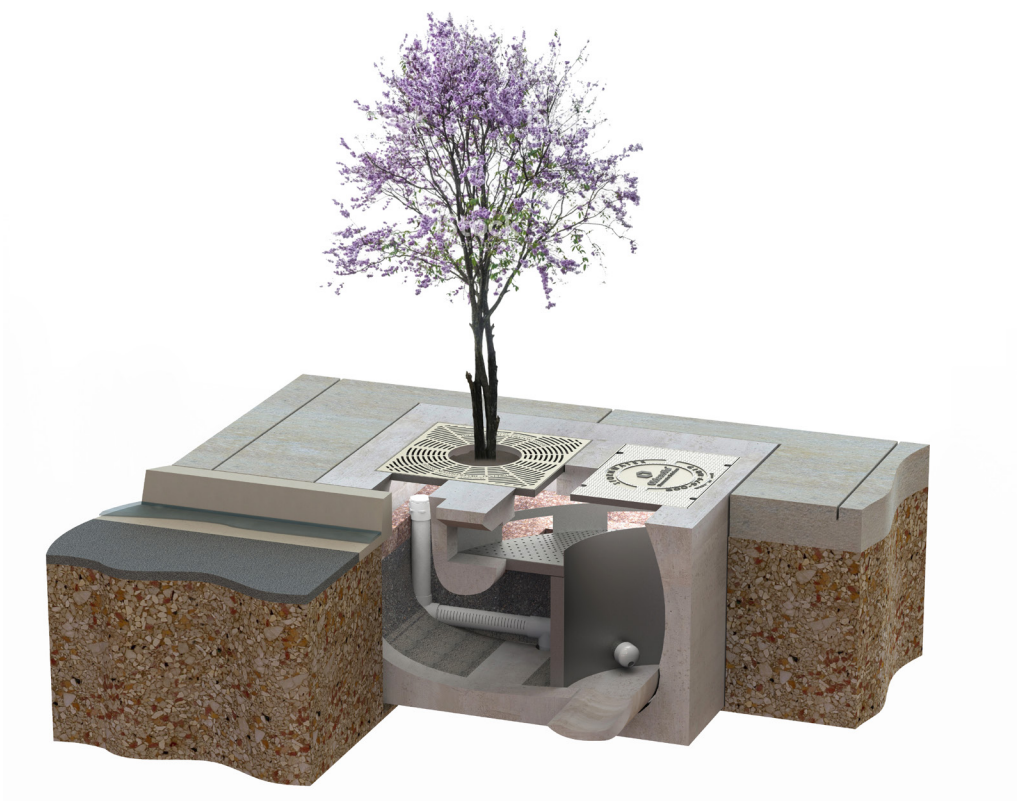
Operations and maintenance instructions for applicable stormwater management facilities are included in the following pages.

Oldcastle Infrastructure™
A CRH COMPANY

BIOPOD™ SYSTEM

WITH STORMMIX™ MEDIA

Inspection and Maintenance Guide



Water

BioPod™ Biofilter with StormMix™ Biofiltration Media

Description

The BioPod™ Biofilter System (BioPod) is a stormwater biofiltration treatment system used to remove pollutants from stormwater runoff. Impervious surfaces and other urban and suburban landscapes generate a variety of contaminants that can enter stormwater and pollute downstream receiving waters unless treatment is provided. The BioPod system uses proprietary StormMix™ biofiltration media to capture and retain pollutants including total suspended solids (TSS), metals, nutrients, gross solids, trash and debris as well as petroleum hydrocarbons.

Function

The BioPod system uses engineered, high-flow rate filter media to remove stormwater pollutants, allowing for a smaller footprint than conventional bioretention systems. Contained within a compact precast concrete vault, the BioPod system consists of a biofiltration chamber and an optional integrated high-flow bypass with a contoured inlet rack to minimize scour. The biofiltration chamber is filled with horizontal layers of aggregate (which may or may not include an underdrain), biofiltration media and mulch. Stormwater passes vertically down through the mulch and biofiltration media for treatment. The mulch provides pretreatment by retaining most of the solids or sediment. The biofiltration media provides further treatment by retaining finer sediment and dissolved pollutants. The aggregate allows the media bed to drain evenly for discharge through an underdrain pipe or by infiltration.

Configuration

The BioPod system can be configured with either an internal or external bypass. The internal bypass allows both water quality and bypass flows to enter the treatment vault. The water quality flows are directed to the biofiltration chamber while the excess flows are diverted over the bypass weir without entering the biofiltration chamber. Both the treatment and bypass flows are combined in the outlet area prior to discharge from the structure. BioPod units without an internal bypass are designed such that only treatment flows enter the treatment structure. When the system has exceeded its treatment capacity, ponding will force bypass flows to continue down the gutter to the nearest standard catch basin or other external bypass structure.

The BioPod system can be configured as a tree box filter with tree and grated inlet, as a planter box filter with shrubs, grasses and an open top, or as an underground filter with access risers, doors and a subsurface inlet pipe. The optional internal bypass may be incorporated with any of these configurations. In addition, an open bottom configuration may be used to promote infiltration and groundwater recharge. The configuration and size of the BioPod system is designed to meet the requirements of a specific project.

Inspection & Maintenance Overview

State and local regulations require all stormwater management systems to be inspected on a regular basis and maintained as necessary to ensure performance and protect downstream receiving waters. Without maintenance, excessive pollutant buildup can limit system performance by reducing the operating capacity of the system and increasing the potential for scouring of pollutants during periods of high flow.

Some configurations of the BioPod may require periodic irrigation to establish and maintain vegetation. Vegetation will typically become established about two years after planting. Irrigation requirements are ultimately dependent on climate, rainfall and the type of vegetation selected.

Maintenance Frequency

Periodic inspection is essential for consistent system performance and is easily completed. Inspection is typically conducted a minimum of twice per year, but since pollutant transport and deposition varies from site to site, a site-specific maintenance frequency should be established during the first two or three years of operation.

Inspection Equipment

The following equipment is helpful when conducting BioPod inspections:

- Recording device (pen and paper form, voice recorder, iPad, etc.)
- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Flashlight
- Tape measure

Inspection Procedures

BioPod inspections are visual and are conducted without entering the unit. To complete an inspection, safety measures including traffic control should be deployed before the access covers or tree grates are removed. Once the covers have been removed, the following items should be checked and recorded (see form provided on page 6) to determine whether maintenance is required:

- If the BioPod unit is equipped with an internal bypass, inspect the contoured inlet rack and outlet chamber and note whether there are any broken or missing parts. In the unlikely event that internal parts are broken or missing, contact Oldcastle Stormwater at (800) 579-8819 to determine appropriate corrective action.
- Note whether the curb inlet, inlet pipe, or – if the unit is equipped with an internal bypass – the inlet rack is blocked or obstructed.
- If the unit is equipped with an internal bypass, observe, quantify and record the accumulation of trash and debris in the inlet rack. The significance of accumulated trash and debris is a matter of judgment. Often, much of the trash and debris may be removed manually at the time of inspection if a separate maintenance visit is not yet warranted.
- If it has not rained within the past 24 hours, note whether standing water is observed in the biofiltration chamber.
- Finally, observe, quantify and record presence of invasive vegetation and the amount of trash and debris and sediment load in the biofiltration chamber. Erosion of the mulch and biofiltration media bed should also be recorded. Sediment load may be rated light, medium or heavy depending on the conditions. Loading characteristics may be determined as follows:
    - Light sediment load – sediment is difficult to distinguish among the mulch fibers at the top of the mulch layer; the mulch appears almost new.
    - Medium sediment load – sediment accumulation is apparent and may be concentrated in some areas; probing the mulch layer reveals lighter sediment loads under the top 1” of mulch.
    - Heavy sediment load – sediment is readily apparent across the entire top of the mulch layer; individual mulch fibers are difficult to distinguish; probing the mulch layer reveals heavy sediment load under the top 1” of mulch.

Often, much of the invasive vegetation and trash and debris may be removed manually at the time of inspection if a separate maintenance visit is not yet warranted.

Maintenance Indicators

Maintenance should be scheduled if any of the following conditions are identified during inspection:

- The concrete structure is damaged or the tree grate or access cover is damaged or missing.
- The curb inlet or inlet rack is obstructed.
- Standing water is observed in the biofiltration chamber more than 24 hours after a rainfall event (use discretion if the BioPod is located downstream of a storage system that attenuates flow).
- Trash and debris in the inlet rack cannot be easily removed at the time of inspection.
- Trash and debris, invasive vegetation or sediment load in the biofiltration chamber is heavy or excessive erosion has occurred.

Maintenance Equipment

The following equipment is helpful when conducting BioPod maintenance:

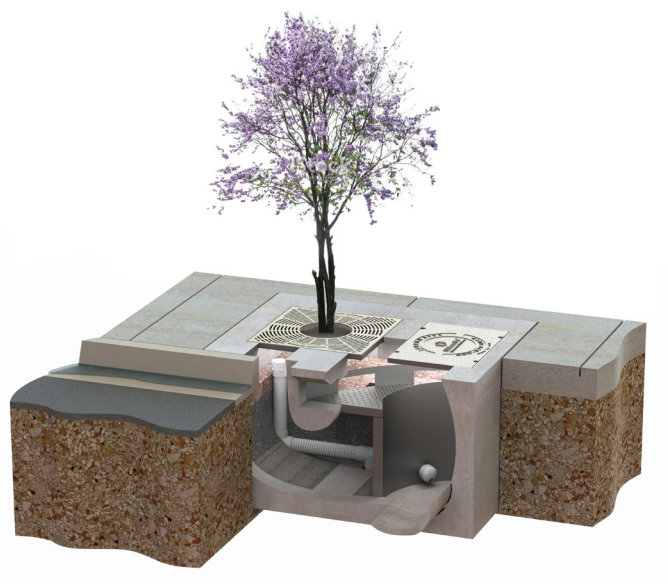
- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Flashlight
- Tape measure
- Rake, hoe, shovel and broom
- Bucket
- Pruners
- Vacuum truck (optional)

Maintenance Procedures

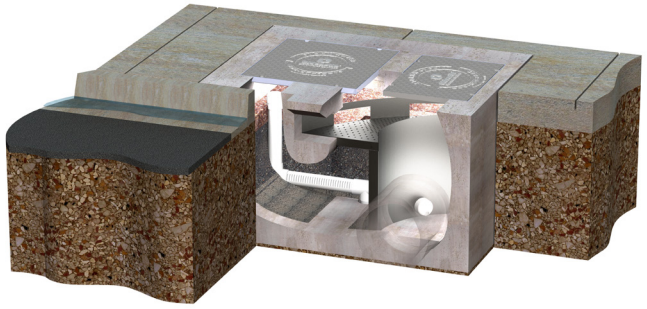
Maintenance should be conducted during dry weather when no flows are entering the system. All maintenance may be conducted without entering the BioPod structure. Once safety measures such as traffic control are deployed, the access covers may be removed and the following activities may be conducted to complete maintenance:

- Remove all trash and debris from the curb inlet and inlet rack manually or by using a vacuum truck as required.
- Remove all trash and debris and invasive vegetation from the biofiltration chamber manually or by using a vacuum truck as required.
- If the sediment load is medium or light but erosion of the biofiltration media bed is evident, redistribute the mulch with a rake or replace missing mulch as appropriate. If erosion persists, rocks may be placed in the eroded area to help dissipate energy and prevent recurring erosion.
- If the sediment load is heavy, remove the mulch layer using a hoe, rake, shovel and bucket, or by using a vacuum truck as required. If the sediment load is particularly heavy, inspect the surface of the biofiltration media once the mulch has been removed. If the media appears clogged with sediment, remove and replace one or two inches of biofiltration media prior to replacing the mulch layer.
- Prune vegetation as appropriate and replace damaged or dead plants as required.
- Replace the tree grate and/or access covers and sweep the area around the BioPod to leave the site clean.
- All material removed from the BioPod during maintenance must be disposed of in accordance with local environmental regulations. In most cases, the material may be handled in the same manner as disposal of material removed from sumped catch basins or manholes.

Natural, shredded hardwood mulch should be used in the BioPod. Timely replacement of the mulch layer according to the maintenance indicators described above should protect the biofiltration media below the mulch layer from clogging due to sediment accumulation. However, whenever the mulch is replaced, the BioPod should be visited 24 hours after the next major storm event to ensure that there is no standing water in the biofiltration chamber. Standing water indicates that the biofiltration media below the mulch layer is clogged and must be replaced. Please contact Oldcastle Infrastructure at (800) 579-8819 to purchase the proprietary StormMix™ biofiltration media.

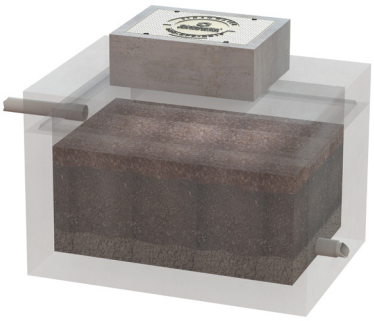


BioPod Tree Module



BioPod Media Module

BioPod Planter Module



BioPod Media Vault

BioPod Inspection & Maintenance Log

BioPod Model_____ **Inspection Date**_____

Location_____

Condition of Internal Components Notes:

☐ Good ☐ Damaged ☐ Missing

Curb Inlet or Inlet Rack Blocked Notes:

☐ Yes ☐ No

Standing Water in Biofiltration Chamber Notes:

☐ Yes ☐ No

Trash and Debris in Inlet Rack Notes:

☐ Yes ☐ No

Trash and Debris in Biofiltration Chamber Notes:

☐ Yes ☐ No

Invasive Vegetation in Biofiltration Chamber Notes:

☐ Yes ☐ No

Sediment in Biofiltration Chamber Notes:

☐ Light ☐ Medium ☐ Heavy

Erosion in Biofiltration Chamber Notes:

☐ Yes ☐ No

Maintenance Requirements

☐ **Yes - Schedule Maintenance** ☐ **No - Schedule Re-Inspection**

BIOPOD™ SYSTEM

WITH STORMMIX™ MEDIA

OUR MARKETS

BUILDING STRUCTURES

COMMUNICATIONS

WATER

ENERGY

TRANSPORTATION

Appendix A

WWHM Reports

WWHM2012
PROJECT REPORT

Project Name: Private vault
Site Name: 21416 Issaquah Holly St
Site Address:
City : Issaquah
Report Date: 6/21/2022
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.33
Version Date: 2021/08/18
Version : 4.2.18

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Public
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.916
Pervious Total	0.916

Impervious Land Use	acre
ROOF TOPS FLAT	0.175
DRIVEWAYS FLAT	0.219
SIDEWALKS FLAT	0.012
Impervious Total	0.406
Basin Total	1.322

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.437
Pervious Total	**0.437**

Impervious Land Use	acre
ROADS FLAT	0.258
ROOF TOPS FLAT	0.517
SIDEWALKS FLAT	0.104
Impervious Total	**0.879**
Basin Total	**1.316**

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Vault 1
Width : 60.5 ft.
Length : 48 ft.
Depth: 4 ft.
Discharge Structure
Riser Height: 3 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 1.625 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 1.75 in. **Elevation:** 1.2 ft.
Orifice 3 Diameter: 1.875 in. **Elevation:** 2.2 ft.

Element Flows To:

Outlet 1	Outlet 2

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.066	0.000	0.000	0.000
0.0444	0.066	0.003	0.015	0.000
0.0889	0.066	0.005	0.021	0.000
0.1333	0.066	0.008	0.026	0.000
0.1778	0.066	0.011	0.030	0.000
0.2222	0.066	0.014	0.033	0.000
0.2667	0.066	0.017	0.037	0.000
0.3111	0.066	0.020	0.040	0.000
0.3556	0.066	0.023	0.042	0.000
0.4000	0.066	0.026	0.045	0.000
0.4444	0.066	0.029	0.047	0.000

0.4889	0.066	0.032	0.050	0.000
0.5333	0.066	0.035	0.052	0.000
0.5778	0.066	0.038	0.054	0.000
0.6222	0.066	0.041	0.056	0.000
0.6667	0.066	0.044	0.058	0.000
0.7111	0.066	0.047	0.060	0.000
0.7556	0.066	0.050	0.062	0.000
0.8000	0.066	0.053	0.064	0.000
0.8444	0.066	0.056	0.065	0.000
0.8889	0.066	0.059	0.067	0.000
0.9333	0.066	0.062	0.069	0.000
0.9778	0.066	0.065	0.070	0.000
1.0222	0.066	0.068	0.072	0.000
1.0667	0.066	0.071	0.074	0.000
1.1111	0.066	0.074	0.075	0.000
1.1556	0.066	0.077	0.077	0.000
1.2000	0.066	0.080	0.078	0.000
1.2444	0.066	0.083	0.097	0.000
1.2889	0.066	0.085	0.106	0.000
1.3333	0.066	0.088	0.113	0.000
1.3778	0.066	0.091	0.119	0.000
1.4222	0.066	0.094	0.124	0.000
1.4667	0.066	0.097	0.129	0.000
1.5111	0.066	0.100	0.134	0.000
1.5556	0.066	0.103	0.138	0.000
1.6000	0.066	0.106	0.143	0.000
1.6444	0.066	0.109	0.147	0.000
1.6889	0.066	0.112	0.151	0.000
1.7333	0.066	0.115	0.155	0.000
1.7778	0.066	0.118	0.158	0.000
1.8222	0.066	0.121	0.162	0.000
1.8667	0.066	0.124	0.165	0.000
1.9111	0.066	0.127	0.169	0.000
1.9556	0.066	0.130	0.172	0.000
2.0000	0.066	0.133	0.175	0.000
2.0444	0.066	0.136	0.178	0.000
2.0889	0.066	0.139	0.181	0.000
2.1333	0.066	0.142	0.185	0.000
2.1778	0.066	0.145	0.187	0.000
2.2222	0.066	0.148	0.205	0.000
2.2667	0.066	0.151	0.218	0.000
2.3111	0.066	0.154	0.228	0.000
2.3556	0.066	0.157	0.236	0.000
2.4000	0.066	0.160	0.244	0.000
2.4444	0.066	0.163	0.251	0.000
2.4889	0.066	0.165	0.258	0.000
2.5333	0.066	0.168	0.265	0.000
2.5778	0.066	0.171	0.271	0.000
2.6222	0.066	0.174	0.277	0.000
2.6667	0.066	0.177	0.282	0.000
2.7111	0.066	0.180	0.288	0.000
2.7556	0.066	0.183	0.293	0.000
2.8000	0.066	0.186	0.298	0.000
2.8444	0.066	0.189	0.304	0.000
2.8889	0.066	0.192	0.309	0.000
2.9333	0.066	0.195	0.313	0.000
2.9778	0.066	0.198	0.318	0.000

3.0222	0.066	0.201	0.358	0.000
3.0667	0.066	0.204	0.510	0.000
3.1111	0.066	0.207	0.722	0.000
3.1556	0.066	0.210	0.974	0.000
3.2000	0.066	0.213	1.248	0.000
3.2444	0.066	0.216	1.529	0.000
3.2889	0.066	0.219	1.797	0.000
3.3333	0.066	0.222	2.037	0.000
3.3778	0.066	0.225	2.237	0.000
3.4222	0.066	0.228	2.391	0.000
3.4667	0.066	0.231	2.504	0.000
3.5111	0.066	0.234	2.621	0.000
3.5556	0.066	0.237	2.721	0.000
3.6000	0.066	0.240	2.817	0.000
3.6444	0.066	0.243	2.909	0.000
3.6889	0.066	0.245	2.999	0.000
3.7333	0.066	0.248	3.086	0.000
3.7778	0.066	0.251	3.170	0.000
3.8222	0.066	0.254	3.252	0.000
3.8667	0.066	0.257	3.331	0.000
3.9111	0.066	0.260	3.409	0.000
3.9556	0.066	0.263	3.485	0.000
4.0000	0.066	0.266	3.560	0.000
4.0444	0.066	0.269	3.632	0.000
4.0889	0.000	0.000	3.703	0.000

Name : Bypass
Bypass: Yes

GroundWater: No

Pervious Land Use	**acre**
Pervious Total	**0**

Impervious Land Use	**acre**
ROADS FLAT	**0.006**
Impervious Total	**0.006**
Basin Total	**0.006**

Element Flows To:

Surface	**Interflow**	**Groundwater**

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.916
Total Impervious Area:0.406

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.437
Total Impervious Area:0.885

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.26813
5 year	0.365623
10 year	0.437348
25 year	0.536476
50 year	0.616722
100 year	0.70265

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.129397
5 year	0.1955
10 year	0.24812
25 year	0.325627
50 year	0.391992
100 year	0.466291

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.399	0.132
1950	0.373	0.138
1951	0.242	0.195
1952	0.169	0.086
1953	0.170	0.108
1954	0.215	0.079
1955	0.240	0.176
1956	0.225	0.145
1957	0.283	0.153
1958	0.208	0.129
1959	0.188	0.119
1960	0.276	0.181
1961	0.230	0.122
1962	0.180	0.071
1963	0.235	0.121
1964	0.200	0.100
1965	0.302	0.128
1966	0.182	0.074
1967	0.376	0.167
1968	0.356	0.089
1969	0.268	0.132
1970	0.251	0.120

1971	0.296	0.131
1972	0.361	0.168
1973	0.163	0.097
1974	0.289	0.074
1975	0.306	0.168
1976	0.227	0.116
1977	0.228	0.073
1978	0.255	0.124
1979	0.314	0.073
1980	0.466	0.160
1981	0.266	0.111
1982	0.428	0.241
1983	0.276	0.136
1984	0.189	0.084
1985	0.247	0.120
1986	0.256	0.218
1987	0.299	0.238
1988	0.180	0.089
1989	0.258	0.063
1990	0.745	0.289
1991	0.484	0.262
1992	0.197	0.106
1993	0.181	0.117
1994	0.160	0.058
1995	0.234	0.139
1996	0.356	0.193
1997	0.278	0.245
1998	0.235	0.113
1999	0.553	0.170
2000	0.260	0.117
2001	0.242	0.074
2002	0.376	0.222
2003	0.340	0.074
2004	0.529	0.592
2005	0.246	0.162
2006	0.227	0.142
2007	0.664	0.306
2008	0.477	0.405
2009	0.307	0.188

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.7447	0.5919
2	0.6640	0.4049
3	0.5533	0.3057
4	0.5286	0.2894
5	0.4842	0.2622
6	0.4775	0.2446
7	0.4656	0.2406
8	0.4282	0.2375
9	0.3989	0.2220
10	0.3761	0.2181
11	0.3761	0.1947
12	0.3728	0.1926
13	0.3612	0.1875

14	0.3564	0.1813
15	0.3559	0.1755
16	0.3396	0.1701
17	0.3143	0.1678
18	0.3074	0.1675
19	0.3060	0.1666
20	0.3017	0.1618
21	0.2986	0.1604
22	0.2959	0.1527
23	0.2892	0.1448
24	0.2834	0.1420
25	0.2778	0.1387
26	0.2763	0.1384
27	0.2763	0.1355
28	0.2678	0.1317
29	0.2659	0.1317
30	0.2604	0.1306
31	0.2580	0.1292
32	0.2560	0.1282
33	0.2551	0.1242
34	0.2507	0.1224
35	0.2475	0.1213
36	0.2456	0.1204
37	0.2424	0.1197
38	0.2417	0.1193
39	0.2396	0.1171
40	0.2350	0.1171
41	0.2350	0.1163
42	0.2340	0.1129
43	0.2296	0.1114
44	0.2282	0.1075
45	0.2270	0.1056
46	0.2268	0.1003
47	0.2251	0.0972
48	0.2152	0.0894
49	0.2075	0.0887
50	0.1996	0.0858
51	0.1971	0.0841
52	0.1886	0.0789
53	0.1882	0.0743
54	0.1822	0.0740
55	0.1808	0.0737
56	0.1801	0.0737
57	0.1799	0.0732
58	0.1703	0.0730
59	0.1691	0.0712
60	0.1625	0.0627
61	0.1605	0.0580

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs) Predev Mit Percentage Pass/Fail

0.1341	1783	1769	99	Pass
0.1389	1614	1584	98	Pass
0.1438	1437	1429	99	Pass
0.1487	1278	1244	97	Pass
0.1536	1108	1078	97	Pass
0.1584	980	946	96	Pass
0.1633	885	810	91	Pass
0.1682	781	676	86	Pass
0.1731	688	557	80	Pass
0.1779	634	473	74	Pass
0.1828	568	383	67	Pass
0.1877	507	314	61	Pass
0.1926	467	276	59	Pass
0.1974	421	255	60	Pass
0.2023	378	247	65	Pass
0.2072	348	231	66	Pass
0.2121	317	214	67	Pass
0.2169	294	203	69	Pass
0.2218	274	186	67	Pass
0.2267	256	177	69	Pass
0.2316	236	169	71	Pass
0.2364	215	152	70	Pass
0.2413	197	138	70	Pass
0.2462	175	126	72	Pass
0.2511	160	118	73	Pass
0.2559	151	111	73	Pass
0.2608	140	102	72	Pass
0.2657	131	94	71	Pass
0.2706	123	89	72	Pass
0.2754	115	82	71	Pass
0.2803	107	78	72	Pass
0.2852	100	71	71	Pass
0.2901	99	63	63	Pass
0.2950	97	59	60	Pass
0.2998	93	54	58	Pass
0.3047	90	44	48	Pass
0.3096	79	37	46	Pass
0.3145	72	34	47	Pass
0.3193	67	31	46	Pass
0.3242	63	30	47	Pass
0.3291	60	28	46	Pass
0.3340	56	27	48	Pass
0.3388	54	25	46	Pass
0.3437	49	25	51	Pass
0.3486	48	24	50	Pass
0.3535	44	22	50	Pass
0.3583	41	19	46	Pass
0.3632	38	18	47	Pass
0.3681	36	17	47	Pass
0.3730	33	17	51	Pass
0.3778	29	15	51	Pass
0.3827	26	15	57	Pass
0.3876	26	14	53	Pass
0.3925	24	14	58	Pass
0.3973	24	14	58	Pass
0.4022	23	13	56	Pass
0.4071	23	10	43	Pass

0.4120	22	10	45	Pass
0.4168	21	8	38	Pass
0.4217	20	8	40	Pass
0.4266	20	8	40	Pass
0.4315	19	8	42	Pass
0.4363	19	7	36	Pass
0.4412	19	7	36	Pass
0.4461	19	6	31	Pass
0.4510	17	6	35	Pass
0.4558	16	5	31	Pass
0.4607	15	4	26	Pass
0.4656	15	4	26	Pass
0.4705	12	3	25	Pass
0.4753	12	3	25	Pass
0.4802	10	3	30	Pass
0.4851	9	3	33	Pass
0.4900	9	3	33	Pass
0.4948	8	3	37	Pass
0.4997	8	3	37	Pass
0.5046	7	3	42	Pass
0.5095	7	3	42	Pass
0.5143	6	3	50	Pass
0.5192	6	3	50	Pass
0.5241	6	3	50	Pass
0.5290	6	3	50	Pass
0.5338	4	3	75	Pass
0.5387	4	2	50	Pass
0.5436	4	2	50	Pass
0.5485	3	2	66	Pass
0.5533	3	2	66	Pass
0.5582	2	2	100	Pass
0.5631	2	1	50	Pass
0.5680	2	1	50	Pass
0.5728	2	1	50	Pass
0.5777	2	1	50	Pass
0.5826	2	1	50	Pass
0.5875	2	1	50	Pass
0.5923	2	0	0	Pass
0.5972	2	0	0	Pass
0.6021	2	0	0	Pass
0.6070	2	0	0	Pass
0.6118	2	0	0	Pass
0.6167	2	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

LID Report

LID Technique	Used for	Total Volume	Volume	Infiltration	Cumulative

Percent	Water Quality	Percent Treatment?	Comment Needs Treatment (ac-ft)	Through Facility (ac-ft)	Volume (ac-ft.)	Volume Infiltration Credit	Volume Infiltrated	Water Quality Treated
Vault 1 POC		N	215.07			N	0.00	
Total Volume Infiltrated			215.07	0.00	0.00		0.00	0.00
0%	No Treat. Credit							

Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

WWHM2012
PROJECT REPORT

Project Name: Public vault
Site Name: 21416 Issaquah Holly St
Site Address:
City : Issaquah
Report Date: 6/21/2022
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.33
Version Date: 2021/08/18
Version : 4.2.18

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Public
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.048
Pervious Total	**0.048**

Impervious Land Use	acre
ROADS FLAT	0.034
Impervious Total	**0.034**
Basin Total	**0.082**

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.034
Pervious Total	**0.034**

Impervious Land Use	acre
ROADS FLAT	0.048
Impervious Total	**0.048**
Basin Total	**0.082**

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Vault 1
Width : 12 ft.
Length : 6 ft.
Depth: 3 ft.
Discharge Structure
Riser Height: 2.2 ft.
Riser Diameter: 9 in.
Orifice 1 Diameter: 0.625 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 0.6875 in. **Elevation:** 1.5 ft.

Element Flows To:

Outlet 1	Outlet 2

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.001653	0.000000	0.000	0.000
0.0333	0.001653	0.000055	0.001	0.000
0.0667	0.001653	0.000110	0.002	0.000
0.1000	0.001653	0.000165	0.003	0.000
0.1333	0.001653	0.000220	0.003	0.000
0.1667	0.001653	0.000275	0.004	0.000
0.2000	0.001653	0.000331	0.004	0.000
0.2333	0.001653	0.000386	0.005	0.000
0.2667	0.001653	0.000441	0.005	0.000
0.3000	0.001653	0.000496	0.005	0.000
0.3333	0.001653	0.000551	0.006	0.000
0.3667	0.001653	0.000606	0.006	0.000
0.4000	0.001653	0.000661	0.006	0.000
0.4333	0.001653	0.000716	0.007	0.000
0.4667	0.001653	0.000771	0.007	0.000
0.5000	0.001653	0.000826	0.007	0.000

0.5333	0.001653	0.000882	0.007	0.000
0.5667	0.001653	0.000937	0.008	0.000
0.6000	0.001653	0.000992	0.008	0.000
0.6333	0.001653	0.001047	0.008	0.000
0.6667	0.001653	0.001102	0.008	0.000
0.7000	0.001653	0.001157	0.008	0.000
0.7333	0.001653	0.001212	0.009	0.000
0.7667	0.001653	0.001267	0.009	0.000
0.8000	0.001653	0.001322	0.009	0.000
0.8333	0.001653	0.001377	0.009	0.000
0.8667	0.001653	0.001433	0.009	0.000
0.9000	0.001653	0.001488	0.010	0.000
0.9333	0.001653	0.001543	0.010	0.000
0.9667	0.001653	0.001598	0.010	0.000
1.0000	0.001653	0.001653	0.010	0.000
1.0333	0.001653	0.001708	0.010	0.000
1.0667	0.001653	0.001763	0.010	0.000
1.1000	0.001653	0.001818	0.011	0.000
1.1333	0.001653	0.001873	0.011	0.000
1.1667	0.001653	0.001928	0.011	0.000
1.2000	0.001653	0.001983	0.011	0.000
1.2333	0.001653	0.002039	0.011	0.000
1.2667	0.001653	0.002094	0.011	0.000
1.3000	0.001653	0.002149	0.012	0.000
1.3333	0.001653	0.002204	0.012	0.000
1.3667	0.001653	0.002259	0.012	0.000
1.4000	0.001653	0.002314	0.012	0.000
1.4333	0.001653	0.002369	0.012	0.000
1.4667	0.001653	0.002424	0.012	0.000
1.5000	0.001653	0.002479	0.013	0.000
1.5333	0.001653	0.002534	0.015	0.000
1.5667	0.001653	0.002590	0.016	0.000
1.6000	0.001653	0.002645	0.017	0.000
1.6333	0.001653	0.002700	0.018	0.000
1.6667	0.001653	0.002755	0.018	0.000
1.7000	0.001653	0.002810	0.019	0.000
1.7333	0.001653	0.002865	0.020	0.000
1.7667	0.001653	0.002920	0.020	0.000
1.8000	0.001653	0.002975	0.021	0.000
1.8333	0.001653	0.003030	0.021	0.000
1.8667	0.001653	0.003085	0.022	0.000
1.9000	0.001653	0.003140	0.022	0.000
1.9333	0.001653	0.003196	0.023	0.000
1.9667	0.001653	0.003251	0.023	0.000
2.0000	0.001653	0.003306	0.024	0.000
2.0333	0.001653	0.003361	0.024	0.000
2.0667	0.001653	0.003416	0.024	0.000
2.1000	0.001653	0.003471	0.025	0.000
2.1333	0.001653	0.003526	0.025	0.000
2.1667	0.001653	0.003581	0.026	0.000
2.2000	0.001653	0.003636	0.026	0.000
2.2333	0.001653	0.003691	0.075	0.000
2.2667	0.001653	0.003747	0.163	0.000
2.3000	0.001653	0.003802	0.275	0.000
2.3333	0.001653	0.003857	0.403	0.000
2.3667	0.001653	0.003912	0.537	0.000
2.4000	0.001653	0.003967	0.670	0.000

2.4333	0.001653	0.004022	0.793	0.000
2.4667	0.001653	0.004077	0.899	0.000
2.5000	0.001653	0.004132	0.984	0.000
2.5333	0.001653	0.004187	1.047	0.000
2.5667	0.001653	0.004242	1.093	0.000
2.6000	0.001653	0.004298	1.151	0.000
2.6333	0.001653	0.004353	1.197	0.000
2.6667	0.001653	0.004408	1.241	0.000
2.7000	0.001653	0.004463	1.284	0.000
2.7333	0.001653	0.004518	1.325	0.000
2.7667	0.001653	0.004573	1.365	0.000
2.8000	0.001653	0.004628	1.404	0.000
2.8333	0.001653	0.004683	1.442	0.000
2.8667	0.001653	0.004738	1.479	0.000
2.9000	0.001653	0.004793	1.515	0.000
2.9333	0.001653	0.004848	1.550	0.000
2.9667	0.001653	0.004904	1.585	0.000
3.0000	0.001653	0.004959	1.618	0.000
3.0333	0.001653	0.005014	1.651	0.000
3.0667	0.000000	0.000000	1.683	0.000

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.048
Total Impervious Area:0.034

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.034
Total Impervious Area:0.048

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.020697
5 year	0.027397
10 year	0.032213
25 year	0.038749
50 year	0.043954
100 year	0.049457

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.012517
5 year	0.017425
10 year	0.021247
25 year	0.026779
50 year	0.031449
100 year	0.036621

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.030	0.015
1950	0.027	0.013
1951	0.018	0.014
1952	0.013	0.010
1953	0.014	0.010
1954	0.017	0.010
1955	0.019	0.014
1956	0.018	0.011
1957	0.022	0.016
1958	0.016	0.011
1959	0.016	0.010
1960	0.020	0.013
1961	0.018	0.011
1962	0.015	0.009
1963	0.018	0.009
1964	0.016	0.011
1965	0.023	0.010
1966	0.014	0.010
1967	0.027	0.013
1968	0.028	0.012
1969	0.020	0.011
1970	0.019	0.011
1971	0.023	0.010
1972	0.026	0.018
1973	0.013	0.010
1974	0.022	0.010
1975	0.023	0.013
1976	0.017	0.010
1977	0.018	0.010
1978	0.020	0.015
1979	0.026	0.011
1980	0.033	0.013
1981	0.021	0.012
1982	0.032	0.023
1983	0.022	0.013
1984	0.015	0.009
1985	0.020	0.011
1986	0.019	0.018
1987	0.025	0.018
1988	0.015	0.009
1989	0.022	0.009
1990	0.051	0.039
1991	0.035	0.024
1992	0.015	0.011
1993	0.015	0.008
1994	0.013	0.008
1995	0.018	0.011
1996	0.025	0.019
1997	0.021	0.017
1998	0.019	0.010
1999	0.042	0.021
2000	0.020	0.012

2001	0.020	0.010
2002	0.028	0.018
2003	0.025	0.010
2004	0.040	0.034
2005	0.018	0.017
2006	0.017	0.010
2007	0.045	0.025
2008	0.034	0.036
2009	0.024	0.019

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0507	0.0394
2	0.0453	0.0357
3	0.0425	0.0344
4	0.0404	0.0254
5	0.0349	0.0243
6	0.0343	0.0230
7	0.0332	0.0210
8	0.0316	0.0194
9	0.0296	0.0193
10	0.0283	0.0185
11	0.0280	0.0184
12	0.0268	0.0181
13	0.0267	0.0180
14	0.0265	0.0170
15	0.0263	0.0170
16	0.0249	0.0158
17	0.0249	0.0154
18	0.0248	0.0150
19	0.0238	0.0145
20	0.0230	0.0141
21	0.0228	0.0135
22	0.0228	0.0129
23	0.0225	0.0129
24	0.0222	0.0129
25	0.0216	0.0129
26	0.0216	0.0128
27	0.0209	0.0125
28	0.0208	0.0119
29	0.0204	0.0116
30	0.0204	0.0113
31	0.0202	0.0112
32	0.0202	0.0111
33	0.0201	0.0111
34	0.0198	0.0111
35	0.0194	0.0108
36	0.0189	0.0108
37	0.0189	0.0108
38	0.0186	0.0107
39	0.0184	0.0106
40	0.0184	0.0105
41	0.0181	0.0104
42	0.0180	0.0102
43	0.0178	0.0101

44	0.0177	0.0101
45	0.0175	0.0101
46	0.0173	0.0101
47	0.0169	0.0100
48	0.0167	0.0100
49	0.0165	0.0099
50	0.0158	0.0098
51	0.0158	0.0098
52	0.0152	0.0098
53	0.0151	0.0097
54	0.0148	0.0096
55	0.0148	0.0095
56	0.0145	0.0095
57	0.0142	0.0091
58	0.0141	0.0091
59	0.0134	0.0088
60	0.0131	0.0083
61	0.0130	0.0082

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0103	1717	1662	96	Pass
0.0107	1538	1396	90	Pass
0.0110	1395	1187	85	Pass
0.0114	1231	976	79	Pass
0.0117	1112	814	73	Pass
0.0120	1007	663	65	Pass
0.0124	892	537	60	Pass
0.0127	796	430	54	Pass
0.0131	727	347	47	Pass
0.0134	652	328	50	Pass
0.0137	587	307	52	Pass
0.0141	531	292	54	Pass
0.0144	492	274	55	Pass
0.0148	449	257	57	Pass
0.0151	417	247	59	Pass
0.0154	385	231	60	Pass
0.0158	347	218	62	Pass
0.0161	329	204	62	Pass
0.0165	303	196	64	Pass
0.0168	279	189	67	Pass
0.0171	259	181	69	Pass
0.0175	242	173	71	Pass
0.0178	222	169	76	Pass
0.0182	206	157	76	Pass
0.0185	191	149	78	Pass
0.0188	174	144	82	Pass
0.0192	165	142	86	Pass
0.0195	148	136	91	Pass
0.0199	139	131	94	Pass
0.0202	128	126	98	Pass

0.0205	121	120	99	Pass
0.0209	114	111	97	Pass
0.0212	110	108	98	Pass
0.0216	107	100	93	Pass
0.0219	103	95	92	Pass
0.0222	96	90	93	Pass
0.0226	93	85	91	Pass
0.0229	86	79	91	Pass
0.0232	80	72	90	Pass
0.0236	74	66	89	Pass
0.0239	67	57	85	Pass
0.0243	65	51	78	Pass
0.0246	64	43	67	Pass
0.0249	60	36	60	Pass
0.0253	56	33	58	Pass
0.0256	51	27	52	Pass
0.0260	49	20	40	Pass
0.0263	45	19	42	Pass
0.0266	39	19	48	Pass
0.0270	36	19	52	Pass
0.0273	35	18	51	Pass
0.0277	33	18	54	Pass
0.0280	32	17	53	Pass
0.0283	27	14	51	Pass
0.0287	26	13	50	Pass
0.0290	26	12	46	Pass
0.0294	24	11	45	Pass
0.0297	23	10	43	Pass
0.0300	23	9	39	Pass
0.0304	20	9	45	Pass
0.0307	20	9	45	Pass
0.0311	20	9	45	Pass
0.0314	20	9	45	Pass
0.0317	18	9	50	Pass
0.0321	18	9	50	Pass
0.0324	18	9	50	Pass
0.0328	18	8	44	Pass
0.0331	18	7	38	Pass
0.0334	15	6	40	Pass
0.0338	15	5	33	Pass
0.0341	15	4	26	Pass
0.0344	13	3	23	Pass
0.0348	11	2	18	Pass
0.0351	9	2	22	Pass
0.0355	8	2	25	Pass
0.0358	8	1	12	Pass
0.0361	7	1	14	Pass
0.0365	7	1	14	Pass
0.0368	7	1	14	Pass
0.0372	7	1	14	Pass
0.0375	6	1	16	Pass
0.0378	6	1	16	Pass
0.0382	4	1	25	Pass
0.0385	4	1	25	Pass
0.0389	4	1	25	Pass
0.0392	4	1	25	Pass
0.0395	4	0	0	Pass

0.0399	4	0	0	Pass
0.0402	4	0	0	Pass
0.0406	3	0	0	Pass
0.0409	3	0	0	Pass
0.0412	3	0	0	Pass
0.0416	3	0	0	Pass
0.0419	3	0	0	Pass
0.0423	3	0	0	Pass
0.0426	2	0	0	Pass
0.0429	2	0	0	Pass
0.0433	2	0	0	Pass
0.0436	2	0	0	Pass
0.0440	2	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

LID Report

LID Technique	Used for Water Quality Treatment?	Total Volume Percent Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Comment
Vault 1 POC	N	12.65			N	
0.00						
Total Volume Infiltrated		12.65	0.00	0.00	0.00	
0.00	0%	No Treat. Credit				

Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.
